Skin and Soft Tissue Substitutes (for Louisiana Only)

Policy Number: CS153LA.~~P~~Q
Effective Date: ~~December 1, 2024~~TBD

➲ Instructions for Use

Table of Contents **Page**

Application

This Medical Policy only applies to the state of Louisiana.

Coverage Rationale

Note: For chronic diabetic lower extremity ulcers, refer to the Medical Policy titled Skin Substitutes for Chronic Diabetic Lower Extremity Ulcers (for Louisiana Only).

TransCyte™

TransCyte is proven and medically necessary for treating surgically excised Full-Thickness Thermal Burn wounds and deep Partial-Thickness Thermal Burn wounds before autograft placement.

TransCyte is unproven and not medically necessary for all other indications due to insufficient evidence of efficacy.

Other Skin and Soft Tissue Substitutes

The following skin and soft tissue substitutes are unproven and not medically necessary for any indication due to insufficient evidence of efficacy:

- ACApatch
- Acesso
- Acesso AC
- Acesso DL
- Acesso TL
- Activate Matrix
- Affinity®
- AlloGen™
- alloPLY
- AlloSkin™
- AlloWrap®
- Altiply®
- AmchoPlast
- American Amnion, American Amnion AC, or American Amnion AC Tri-Layer
- AmniCore Pro
- AmniCore Pro+
- ~~AmnioTX~~
- Amnio Quad-Core
- Amnio Tri-Core Amniotic
- Amnio Wound™
- Amnio Wrap2™
- AmnioAMP-MP™
- AmnioArmor™
- AmnioBand®
- AmnioBind or DermaBind TL
- AmnioCore TM

- Amniocyte Plus™
- AMNIOEXCEL®, AMNIOEXCEL Plus, or BioDExcel™
- AmnioFix®
- AMNIOMATRIX® or BioDMatrix™
- Amnio-Maxx™ or Amnio-Maxx™ Lite
- AmnioRepair
- **AmnioPlast 1, AmnioPlast 2**
- Amniotext
- Amniotext patch
- AmnioTX
- Amnion Bio™
- AMNIPLY™
- Apis®
- Architect®
- ArdeoGraft
- Artacent® Cord
- Artacent ~~Wound~~ **C, Artacent AC, Artacent Trident, Artacent Velos, Artacent Vericlen** or Artacent ~~AC~~**Wound**
- ArthroFLEX®
- Ascent™
- AxoBioMembrane™
- Axolotl™ Ambient or Axolotl Cryo
- Axolotl Graft
- Axolotl DualGraft
- Barrera™ SL or Barrera™ DL, per sq cm
- BellaCell HD™
- bio-ConneKt®
- BioDfence™ or BioDFence DryFlex™
- Bioskin™
- Bioskin Flow
- Biovance®, Biovance® Tri-Layer, or Biovance® 3L
- BioWound™, BioWound Plus, or BioWound Xplus
- CaregraFT
- CarePATCH™
- Celera Dual Layer or Celera Dual Membrane
- Cellesta™ or Cellesta Duo
- Cellesta Cord
- Cellesta Flowable Amnion
- CLARIX®
- CLARIX FLO®
- Cocoon membrane
- Cogenex (amniotic membrane and flowable amnion)
- Coll-e-Derm™
- Complete AA
- Complete ACA
- Complete™ FT
- Complete™ SL
- Conexa™
- Corecyte™
- Coretext™ or Protext™
- CorMatrix®
- Corplex™
- Corplex p
- Cryo-Cord™
- Cygnus™, Cygnus® Dual, or Cygnus® Matrix
- Cymetra™
- Cytal™
- DermaBind CH, DermaBind DL, DermaBind FM, or DermaBind SL™
- DermACELL®~~*~~, DermACELL AWM®, or DermACELL AWM Porous *(refer to the asterisked note below when DermACELL is used during breast reconstruction)*
- **Dermacyte AC Matrix Amniotic Membrane Allograft or** Dermacyte® Amniotic Membrane Allograft®
- Derma-Gide™
- DermaPure™
- DermaSpan™
- Dermavest® or Plurivest®
- Derm-Maxx
- Dual Layer Impax™
- DuoAmnion
- E-Graft
- Emerge Matrix
- Enverse
- EpiCord®
- EPIEFFECT™
- EpiFix®, injectable
- Esano™ A, Esano AAA, Esano AC, or Esano ACA
- Excellagen®
- E-Z Derm®
- FlowerAmnioFlo™ or FlowerFlo™
- FlowerAmnioPatch™ or FlowerPatch™
- FlowerDerm™
- Fluid Flow™
- Fluid GF™
- GammaGraft™
- Genesis Amniotic Membrane
- Grafix Core
- ~~Grafix Plus~~
- **GRAFIX PLUS**
- Guardian
- Helicoll™
- hMatrix®
- Human Health Factor 10 Amniotic Patch (HHF10-P)
- Hyalomatrix®
- InnovaMatrix AC or Innovamatrix FS
- Integra® Flowable Wound Matrix
- InteguPly®
- Interfyl™
- Keramatrix®
- Kerasorb®
- Kerecis™ Omega3, Kerecis® Omega3 MariGen® Shield
- Keroxx™
- Lamellas and Lamellas XT
- **MatriDerm**
- Matrion™
- MatriStem® MicroMatrix®
- **Matrix HD Allograft Dermis**
- Mediskin™
- Membrane Graft™
- Membrane Wrap-Hydro or Membrane Wrap™
- MemoDerm™
- Microlyte Matrix
- MIRODERM™
- **MicroMatrix Flex**
- Mirragen Advanced Wound Matrix
- **MiroTract Wound Matrix**
- ~~MIRODERM™~~
- MLG-Complete
- MOST
- MyOwn Skin™
- NeoMatriX
- NeoPatch™
- NeoStim Membrane, NeoStim TL Membrane, NeoStimDL
- NEOX®

- NEOX FLO®
- Novachor™
- Novafix™
- Novafix™ DL
- NovoSorb SynPath
- NuDYN™
- NuShield®
- Omeza Collagen Matrix
- ORION
- PalinGen® Amniotic Tissue Allograft and PalinGen Flow products
- PelloGraft
- PermeaDerm B
- PermeaDerm ~~glove~~**C**
- PermeaDerm ~~C~~**Glove**
- Phoenix Wound Matrix®
- Polycyte™
- PriMatrix®
- Procenta®
- ProgenaMatrix™
- ProMatrX™
- PuraPly®, PuraPly AM, or PuraPly XT
- Rebound Matrix
- Reeva FT
- RegeneLink Amniotic Membrane Allograft
- REGUaRD™
- Relese
- RenoGraft
- Repriza®
- Restorigin™
- Restrata~~,~~ or Restrata MiniMatrix
- Revita™
- Revitalon®
- RevoShield+ Amniotic Barrier
- SanoGraft
- Sanopellis
- Signature APatch
- **SimpliGraft or SimpliMax**
- Singlay
- SkinTE™
- STRATTICE™
- Stravix™ or StravixPL™
- Supra SDRM
- ~~Suprathel~~
- **SUPRATHEL**
- Surederm™
- ~~Surfactor®~~
- **SurFactor®**
- SurgiCORD™
- SurgiGRAFT™
- SurgiGRAFT-DUAL
- SurGraft™ SurGraft FT, SurGraft TL, SurGraft XT
- ~~SurgiCORD™~~
- ~~SurgiGRAFT™~~
- ~~SurgiGRAFT-DUAL~~
- Symphony
- TAG
- Talymed®
- TenSIX®
- TheraGenesis
- **TheraMend**
- TheraSkin®
- Therion™
- TOTAL
- TranZgraft®
- **Tri-Membrane Wrap**
- TruSkin™
- Vendaje
- Vendaje A
- VIA Matrix
- Vim
- VitoGraft
- WoundEx®
- WoundEx™ Flow
- WoundFix™, WoundFix Plus, or WoundFix Xplus
- WoundPlus Membrane
- Xcell Amnio Matrix®
- ~~XCelliStem~~
- XCellerate™
- XCelliStem
- XCM BIOLOGIC® Tissue Matrix
- XWRAP™
- Zenith Amniotic Membrane

*Refer to the Medical Policy titled Breast Reconstruction (for Louisiana Only) for information about coverage for skin and soft tissue substitutes used during post mastectomy breast reconstruction procedures.

Note: Refer to the Clinical Evidence section for specific product information**.**

Definitions

~~**Acellular Matrix**: A matrix that is derived from sources other than human skin. Acellular Matrices are the most frequently used skin substitute. Acellular Matrices are composed of allogeneic or xenogeneic derived collagen, membrane, or cellular remnants (Debels et al., 2015; Ferreira et al., 2011; Nicholas et al., 2016; Vig et al., 2017).~~

~~**Allogeneic Matrix**: A matrix that is derived from human tissue such as neonatal fibroblasts of the foreskin (Debels et al., 2015; Ferreira et al., 2011; Nicholas et al., 2016; Vig et al., 2017).~~

~~**Composite Matrix**: A matrix that is derived from human keratinocytes and fibroblasts supported by a scaffold of synthetic mesh or xenogeneic collagen. These matrices contain active cellular components that continue to generate compounds and protein that may accelerate wound healing (Debels et al., 2015; Ferreira et al., 2011; Nicholas et al., 2016; Vig et al., 2017).~~

Full-Thickness Thermal Burn (Third Degree Burn): A burn with destruction of all layers of the skin. These burns involve all of the epidermal and dermal layers, with varying amounts of the sub-cutaneous layer involvement (Gomez and Cancio, 2007).

~~**Human Skin Allograft**: An allograft that is derived from donated human skin (e.g., cadavers) that has been processed to remove the cellular components (Debels et al., 2015; Ferreira et al., 2011; Nicholas et al., 2016; Vig et al., 2017).~~

~~**Measurable Signs of Healing**: Wound is diminishing in size (either surface or depth) and there is decreased amount of exudate and necrotic tissue (Gould et al., 2016).~~

Partial-Thickness Thermal Burn (Second Degree Burn): A burn that involves the epidermis and only part of the dermis. Deep Partial-~~-~~Thickness Thermal Burns involve the epidermis and most parts of the dermis, leaving few intact skin appendages and nerve endings (Gomez and Cancio, 2007).

~~**Xenograft**: Skin from another species (e.g., cows, pigs, horses, fish, etc.).~~

Applicable Codes

The following list(s) of procedure and/or diagnosis codes is provided for reference purposes only and may not be all inclusive. Listing of a code in this policy does not imply that the service described by the code is a covered or non-covered health service. Benefit coverage for health services is determined by federal, state, or contractual requirements and applicable laws that may require coverage for a specific service. The inclusion of a code does not imply any right to reimbursement or guarantee claim payment. Other Policies and Guidelines may apply.

HCPCS Code	Description
*A2001	~~Innovamatrix~~**InnovaMatrix** AC, per sq cm
*A2002	Mirragen Advanced Wound Matrix, per sq cm
*A2004	XCelliStem, 1mg
*A2005	Microlyte Matrix, per sq cm
*A2006	NovoSorb SynPath dermal matrix, per sq cm
*A2007	Restrata, per sq cm
*A2008	TheraGenesis, per sq cm
*A2009	Symphony, per sq cm
*A2010	Apis, per sq cm
*A2011	Supra SDRM, per sq cm
*A2012	SUPRATHEL, per sq cm
*A2013	InnovaMatrix FS, per sq cm
*A2014	Omeza Collagen Matrix, per 100 mg
*A2015	Phoenix wound matrix, per sq cm
*A2016	PermeaDerm B, per sq cm
*A2017	PermeaDerm glove, each
*A2018	PermeaDerm C, per sq cm
*A2019	Kerecis Omega3 MariGen Shield, per sq cm
*A2021	NeoMatriX, per sq cm
***** A2026	Restrata MiniMatrix, 5 mg
***A2027**	**MatriDerm, per sq cm**
***A2028**	**MicroMatrix Flex, per mg**
***A2029**	**MiroTract Wound Matrix sheet, per cc**
*A4100	Skin substitute, FDA-cleared as a device, not otherwise specified

HCPCS Code	Description
*Q4100	Skin substitute, not otherwise specified
*Q4110	PriMatrix, per sq cm
*Q4111	GammaGraft, per sq cm
*Q4112	Cymetra, injectable, 1 cc
*Q4114	Integra flowable wound matrix, injectable, 1 cc
*Q4115	AlloSkin, per sq cm
*Q4117	HYALOMATRIX, per sq cm
*Q4118	MatriStem micromatrix, 1 mg
Q4121	TheraSkin, per sq cm
*Q4122	DermACELL, DermACELL AWM or DermACELL AWM Porous, per sq cm
*Q4123	AlloSkin RT, per sq cm
*Q4125	Arthroflex, per sq cm
*Q4126	MemoDerm, DermaSpan, TranZgraft or IntéguPly, per sq cm
*Q4127	Talymed, per sq cm
*Q4130	Strattice™, per sq cm
*Q4132	Grafix Core and GrafixPL Core, per sq cm
*Q4133	Grafix PRIME, GrafixPL PRIME, Stravix and StravixPL, per sq cm
*Q4134	HMatrix, per sq cm
*Q4135	Mediskin, per sq cm
*Q4136	E-Z Derm, per sq cm
*Q4137	AmnioExcel, AmnioExcel Plus or BioDExcel, per sq cm
*Q4138	BioDFence DryFlex, per sq cm
*Q4139	AmnioMatrix or BioDMatrix, injectable, 1 cc
*Q4140	BioDFence, per sq cm
*Q4141	AlloSkin AC, per sq cm
*Q4142	Xcm biologic tissue matrix, per sq cm
*Q4143	Repriza, per sq cm
*Q4145	EpiFix, injectable, 1 mg
*Q4146	Tensix, per sq cm
*Q4147	Architect, Architect PX, or Architect FX, extracellular matrix, per sq cm
*Q4148	Neox Cord 1K, Neox Cord RT, or Clarix Cord 1K, per sq cm
*Q4149	Excellagen, 0.1 cc
*Q4150	AlloWrap DS or dry, per sq cm
*Q4151	AmnioBand or Guardian, per sq cm
*Q4152	DermaPure, per sq cm
*Q4153	Dermavest and Plurivest, per sq cm
*Q4154	Biovance, per sq cm
*Q4155	Neox Flo or Clarix Flo 1 mg
*Q4156	Neox 100 or Clarix 100, per sq cm
*Q4157	Revitalon, per sq cm
*Q4158	Kerecis Omega3, per sq cm

HCPCS Code	Description
*Q4159	Affinity, per sq cm
Q4160	Nushield, per sq cm
*Q4161	Bio-connekt wound matrix, per sq cm
*Q4162	WoundEx Flow, BioSkin Flow, 0.5 cc
*Q4163	WoundEx, BioSkin, per sq cm
*Q4164	Helicoll, per sq cm
*Q4165	Keramatrix or Kerasorb, per sq cm
*Q4166	Cytal, per sq cm
*Q4167	Truskin, per sq cm
*Q4168	Amnioband, 1 mg
*Q4169	Artacent wound, per sq cm
*Q4170	Cygnus, per sq cm
*Q4171	Interfyl, 1 mg
*Q4173	Palingen or palingen xplus, per sq cm
*Q4174	Palingen or promatrx, 0.36 mg per 0.25 cc
*Q4175	Miroderm, per sq cm
*Q4176	Neopatch, per sq cm
*Q4177	Floweramnioflo, 0.1 cc
*Q4178	Floweramniopatch, per sq cm
*Q4179	Flowerderm, per sq cm
*Q4180	Revita, per sq cm
*Q4181	Amnio wound, per sq cm
*Q4182	Transcyte, per sq cm
*Q4183	Surgigraft, per sq cm
*Q4184	Cellesta or Cellesta Duo, per sq cm
*Q4185	Cellesta Flowable Amnion (25 mg per cc); per 0.5
Q4186	Epifix, per sq cm
*Q4187	Epicord, per sq cm
*Q4188	AmnioArmor, per sq cm
*Q4189	Artacent AC, 1 mg
*Q4190	Artacent AC, per sq cm
*Q4191	Restorigin, per sq cm
*Q4192	Restorigin, 1 cc
*Q4193	Coll-e-Derm, per sq cm
*Q4194	Novachor, per sq cm
Q4195	PuraPly, per sq cm
Q4196	PuraPly AM, per sq cm
*Q4197	PuraPly XT, per sq cm
*Q4198	Genesis Amniotic Membrane, per sq cm
*Q4199	Cygnus matrix, per sq cm
*Q4200	SkinTE, per sq cm

HCPCS Code	Description
*Q4201	Matrion, per sq cm
*Q4202	Keroxx (2.5 g/cc), 1 cc
*Q4203	Derma-Gide, per sq cm
*Q4204	XWRAP, per sq cm
*Q4205	Membrane graft or membrane wrap, per sq cm
*Q4206	Fluid Flow or Fluid GF, 1 cc
*Q4208	Novafix, per sq cm
*Q4209	SurGraft, per sq cm
*Q4211	Amnion Bio or AxoBioMembrane, per sq cm
*Q4212	AlloGen, per cc
*Q4213	Ascent, 0.5 mg
*Q4214	Cellesta Cord, per sq cm
*Q4215	Axolotl Ambient or Axolotl Cryo, 0.1 mg
*Q4216	Artacent Cord, per sq cm
*Q4217	WoundFix, BioWound, WoundFix Plus, BioWound Plus, WoundFix Xplus or BioWound Xplus, per sq cm
*Q4218	SurgiCORD, per sq cm
*Q4219	SurgiGRAFT-DUAL, per sq cm
*Q4220	BellaCell HD or Surederm, per sq cm
*Q4221	Amnio Wrap2, per sq cm
*Q4222	ProgenaMatrix, per sq cm
*Q4224	Human Health Factor 10 Amniotic Patch (HHF10-P), per sq cm
*Q4225	AmnioBind or DermaBind TL, per sq cm
*Q4226	MyOwn Skin, includes harvesting and preparation procedures, per sq cm
*Q4227	AmnioCore™, per sq cm
*Q4229	Cogenex Amniotic Membrane, per sq cm
*Q4230	Cogenex flowable amnion, per 0.5 cc
*Q4231	Corplex p, per cc
*Q4232	Corplex, per sq cm
*Q4233	Surfactor or nudyn, per 0.5 cc
*Q4234	Xcellerate, per sq cm
*Q4235	AMNIOREPAIR or AltiPly, per sq cm
*Q4236	carePATCH, per sq cm
*Q4237	Cryo-Cord, per sq cm
*Q4238	Derm-Maxx, per sq cm
*Q4239	Amnio-Maxx or Amnio-Maxx Lite
*Q4240	Corecyte, for topical use only, per 0.5 cc
*Q4241	Polycyte, for topical use only, per 0.5 cc
*Q4242	Amniocyte plus, per 0.5 cc
*Q4245	Amniotext, per cc
*Q4246	Coretext or protext, per cc

HCPCS Code	Description
*Q4247	Amniotext patch, per sq cm
*Q4248	Dermacyte Amniotic Membrane Allograft, per sq cm
*Q4249	AMNIPLY, for topical use only, per sq cm
*Q4250	AmnioAmp-MP, per sq cm
*Q4251	Vim, per sq cm
*Q4252	Vendaje, per sq cm
*Q4253	Zenith amniotic membrane, per sq cm
*Q4254	Novafix DL, per sq cm
*Q4255	REGUaRD, for topical use only, per sq cm
*Q4256	MLG-Complete, per sq cm
*Q4257	Relese, per sq cm
*Q4258	Enverse, per sq cm
*Q4259	Celera Dual Layer or Celera Dual Membrane, per sq cm
*Q4260	Signature APatch, per sq cm
*Q4261	TAG, per sq cm
*Q4262	Dual Layer impax Membrane, per sq cm
*Q4263	SurGraft TL, per sq cm
*Q4264	Cocoon membrane, per sq cm
*Q4265	NeoStim TL, per sq cm
*Q4266	NeoStim Membrane, per sq cm
*Q4267	NeoStim DL, per sq cm
*Q4268	SurGraft FT, per sq cm
*Q4269	SurGraft XT, per sq cm
*Q4270	Complete SL, per sq cm
*Q4271	Complete FT, per sq cm
*Q4272	Esano A, per sq cm
*Q4273	Esano AAA, per sq cm
*Q4274	Esano AC, per sq cm
*Q4275	Esano ACA, per sq cm
*Q4276	ORION, per sq cm
*Q4278	EPIEFFECT, per sq cm
*Q4279	Vendaje AC, per sq cm
*Q4280	Xcell Amnio Matrix, per sq cm
*Q4281	Barrera SL or Barrera DL, per sq cm
*Q4282	Cygnus Dual, per sq cm
*Q4283	Biovance Tri-Layer or Biovance 3L, per sq cm
*Q4284	DermaBind SL, per sq cm
*Q4287	DermaBind DL, per sq cm
*Q4288	DermaBind CH, per sq cm
*Q4289	RevoShield+ Amniotic Barrier, per sq cm
*Q4290	Membrane Wrap-Hydro™, per sq cm

HCPCS Code	Description
*Q4291	Lamellas XT, per sq cm
*Q4292	Lamellas, per sq cm
*Q4293	Acesso DL, per sq cm
*Q4294	Amnio Quad-Core, per sq cm
*Q4295	Amnio Tri-Core Amniotic, per sq cm
*Q4296	Rebound Matrix, per sq cm
*Q4297	Emerge Matrix, per sq cm
*Q4298	AmniCore Pro, per sq cm
*Q4299	AmniCore Pro+, per sq cm
*Q4300	Acesso TL, per sq cm
*Q4301	Activate Matrix, per sq cm
*Q4302	Complete ACA, per sq cm
*Q4303	Complete AA, per sq cm
*Q4304	GRAFIX PLUS, per sq cm
*Q4305	American Amnion AC Tri-Layer, per sq cm
*Q4306	American Amnion AC, per sq cm
*Q4307	American Amnion, per sq cm
*Q4308	Sanopellis, per sq cm
*Q4309	VIA Matrix, per sq cm
*Q4310	Procenta, per 100 mg
*Q4311	Acesso, per sq cm
*Q4312	Acesso AC, per sq cm
*Q4313	DermaBind FM, per sq cm
*Q4314	Reeva FT, per sq cm
*Q4315	RegeneLink Amniotic Membrane Allograft, per sq cm
*Q4316	AmchoPlast, per sq cm
*Q4317	VitoGraft, per sq cm
*Q4318	E-Graft, per sq cm
*Q4319	SanoGraft, per sq cm
*Q4320	PelloGraft, per sq cm
*Q4321	RenoGraft, per sq cm
*Q4322	CaregraFT, per sq cm
*Q4323	alloPLY, per sq cm
*Q4324	AmnioTX, per sq cm
*Q4325	ACApatch, per sq cm
*Q4326	WoundPlus, per sq cm
*Q4327	DuoAmnion, per sq cm
*Q4328	MOST, per sq cm
*Q4329	Singlay, per sq cm
*Q4330	TOTAL, per sq cm
*Q4331	Axolotl Graft, per sq cm

HCPCS Code	Description
*Q4332	Axolotl DualGraft, per sq cm
*Q4333	ArdeoGraft, per sq cm
***Q4334**	**AmnioPlast 1, per sq cm**
***Q4335**	**AmnioPlast 2, per sq cm**
***Q4336**	**Artacent C, per sq cm**
***Q4337**	**Artacent Trident, per sq cm**
***Q4338**	**Artacent Velos, per sq cm**
***Q4339**	**Artacent Vericlen, per sq cm**
***Q4340**	**SimpliGraft, per sq cm**
***Q4341**	**SimpliMax, per sq cm**
***Q4342**	**TheraMend, per sq cm**
***Q4343**	**Dermacyte AC Matrix Amniotic Membrane Allograft, per sq cm**
***Q4344**	**Tri-Membrane Wrap, per sq cm**
***Q4345**	**Matrix HD Allograft Dermis, per sq cm**

Codes labeled with an asterisk (*) are not on the State of Louisiana Medicaid Fee Schedule and therefore may not be covered by the State of Louisiana Medicaid Program

Description of Services

Skin substitutes also known as bioengineered, tissue-engineered, or artificial skin, are a mixed group of biologic, synthetic, or biosynthetic materials that can provide temporary or permanent coverage of wounds of various etiologies. Their goal is to mimic the properties of normal skin to create an environment to promote healing. Skin substitutes are an important adjunctive treatment in the management of acute or uninfected chronic wounds in addition to other soft tissue indications.

There is no universal classification system that allows for simple categorization of all the products that are currently commercially available. Davison-Kotler's (2018) most recent system organized skin substitutes according to **the following factors:**

- cellularity (cellular, acellular~~),~~)
- layering (single layer, bilayer~~),~~)
- replaced region (i.e., epidermis, dermis, or both~~),~~)
- materials used (biologic, synthetic, or both~~), and~~)
- permanence (temporary, permanent).

Kumar (2008, updated 2023) developed the most commonly used classification system in which three classes were proposed.

- **Class 1 Skin substitute :**
  - **A. Temporary impervious dressing materials without negative pressure**
    - **Single-layer material:**
      i. Naturally occurring membrane/cover as biological dressing substitute, for example, amniotic membrane, potato peel.
      ii. Single-layer synthetic skin dressing material substitute, for example, synthetic polymer sheet
    - **Bi-layered tissue engineered material**
  - **B. Temporary impervious dressing materials with negative pressure : for example, LAD without interface material like sponge used in vacuum-assisted closure therapy. Under LAD collection will be removed by negative pressure and also, it will prevent/clear infection leading to healing or requiring further surgical intervention for healing.**

- **Class 2 Skin substitute— Single-layer durable substitutes:**
  - **i. Epidermal substitutes.**
  - **ii. Dermal substitutes (bovine collagen sheet, porcine collagen sheet, bovine collagen matrix)**
- **Class 3 Skin substitute —Composite skin substitutes**
  - **i. Skin graft (allograft-cadaver skin, Xenograft-pig).**
  - **ii. Bioengineered skin**

The most common commercially available skin substitute products are acellular dermal substitutes made from natural biological materials from which the living cells have been removed~~.~~ **for treating or managing chronic wounds.** These include **decellularized** donated human dermis, human placental membranes, and animal tissue. Regardless of the source, the skin substitute provides a matrix into which cells can migrate to induce tissue regeneration and begin wound healing.

Chronic Wounds

Wounds are disturbances of the skin's structural and functional integrity and generally move through separate phases of healing until the skin's structure and function are restored. ~~Patients~~**Individuals** with chronic wounds, such as pressure ulcers and venous leg ulcers, experience loss of function, pain, wound recurrence, and significant morbidity. The standard of care for all chronic wound types includes debridement of necrotic tissue, maintaining moisture balance, preventing, and treating infection, correct ischemia, and compression (for venous leg ulcers). Four weeks of standard treatments without a 50% reduction in wound size may require a change of, or additional therapies.

Burns

For burn injuries, historically, autologous skin grafts have been the only way to provide skin coverage following debridement. However this can result in disfigurement and scarring of the donor site, as well as the potential lack of donor sites in severe cases. Dermal substitutes are an acceptable option for acute partial or full thickness burns, as well as partial thickness hypertrophic scars and contractures.

Other Soft Tissue Indications

Skin and soft tissue substitutes can also be used for repair, reconstruction, and reinforcement of tendons, injection laryngoplasty, various cardiac applications including pericardial reconstruction, valve reconstruction, and acquired vascular defects, as well as trauma that results in skin avulsions and degloving injuries.

The number of products and the rate at which they are being developed and becoming available for use clinically make it a challenge to perform high quality studies to compare the effectiveness of one product over another. ~~There is currently an ongoing clinical trial being conducted by St. Luke's Wound Care Clinic in Texas to develop a Cellular and Tissue Based Therapy Registry (CTPR) for Wounds. It is sponsored in collaboration with the U.S. Wound Registry. Data is submitted by hospital outpatient departments regarding all cellular and tissue-based products currently reimbursed in the hospital-based outpatient department. Additional information can be found at: https://clinicaltrials.gov/ct2/show/NCT02322554. (Accessed April 22, 2024)~~

Many skin and tissue substitutes are included in ~~and~~ ongoing clinical trials. Refer to the following for more information: www.clinicaltrials.gov/.

Clinical Evidence

Systematic Reviews, Meta-Analyses, Guidelines and Technology Assessments That Address Multiple Skin Substitutes

Sui et al. (2024) conducted a systematic review of 15 randomized controlled trials (RCTs) to evaluate the effectiveness and safety of the application of dermal matrix therapy as an adjuvant treatment of SOC. Diabetic foot ulcers (DFUs) can lead to diabetic foot infection (DFI), lower leg amputation, and even result in mortality. While standard of care (SOC) practices have been known as the "gold standard" for DFU care, SOC alone may not be enough to heal all DFUs and prevent recurrence. This study included a total of 1524 subjects. Of these,

689 individuals were treated with SOC alone, while 835 individuals received SOC plus dermal matrix. Compared to the SOC group, significantly shorter time (MD = 2.84, 95%CI: 1.37 ~ 4.32, p < 0.001) was required to achieve complete healing in dermal matrix group. Significantly higher complete healing rate (OR = 0.40, 95%CI: 0.33 ~ 0.49, p < 0.001) and lower overall (RR = 1.83, 95%CI: 1.15 ~ 2.93, p = 0.011*) and major (RR = 2.64, 95%CI: 1.30 ~ 5.36, p = 0.007) amputation risks were achieved in dermal matrix group compared to SOC group. There was so significant difference in the wound area, ulcer recurrence rate, and complication risk between the two groups. Study limitations included a small sample size, variation in products amongst manufacturers which may result in bias, the trials were not blinded, lack of concealment to the investigator and variation in follow-up times. The authors conclude that dermal matrix used as an adjuvant therapy in conjunction with SOC effectively improved the healing process of DFUs and reduced the amputation risk when compared to SOC alone. This use of dermal matrix was also well tolerated by the individuals with no additional risk of complications. (Cazzell 2017; 2019b and Zelen 2016 are included in this study.

Alomairi et al. (2024) conducted a systematic review and meta-analysis to assess the application and effectiveness of HAM in the treatment of diabetic and venous leg ulcers in an attempt to improve the management of chronic wounds. This review included 10 RCTs involving 633 individuals that were randomly assigned to either a treatment group receiving amniotic membrane (n=323) or a control group receiving standard of care (n=310). Human amniotic membrane was used in all studies rather than synthetic types. Diabetes was the primary cause of the ulcer. The ulcers had a mean size of 4.3 cm^2 in the standard care group and 3.6 cm^2 in the amniotic membrane group. Findings revealed that HAM treatment significantly accelerated ulcer closure, demonstrating over 90% complete healing compared to standard care. The authors noted that there were a number of complications during treatment. The follow-up was limited to 12-16 weeks proving only short term efficacy and exposing possible complications from the treatment itself. Study limitations included a limited number of RCTs, small sample sizes in some studies, and a large elderly male individual population, which may affect healing times. In addition, there was no standardized protocol for HAM preparation, possibly affecting product quality. The majority of the studies focused on diabetic individuals with leg ulcers. Also, short-term follow-up across trials varied between six and 16 weeks, emphasizing a need to evaluate HAM's long-term efficacy and safety. Added research is needed, particularly focusing on a diverse array of cutaneous ulcers, given the majority of the studies primarily addressed diabetic ulcers and often had small sample sizes. (Serena 2022, Serena 2020, Snyder 2016, Bianchi 2018, DiDomenico 2016, Lavery 2014, Zelen 2014, Tettelbach 2019, Zelen 2013, Zelen 2016 are all included in this review)

A Hayes Health Technology Assessment for Skin Substitutes for Venous Leg Ulcers in Adults concluded that a low-quality body of evidence provided consistent evidence suggesting acellular and cellular skin substitutes may improve healing of chronic venous leg ulcers when used in conjunction with standard wound care (SWC). The Hayes report gives it a 'C' rating for use of acellular or cellular skin substitutes as an adjunct to standard wound care (SWC) to treat adults with chronic, uninfected venous leg ulcers that have not healed with SWC alone. Evidence directly comparing different cellular skin substitutes with SWC alone and for skin substitute products or types is extremely limited and of very low quality. Skin substitutes appear to be safe and no major safety concerns were reported. Additional, large, well-designed clinical trials are needed to better evaluate the comparative effectiveness and safety of skin substitutes as adjuncts to SWC and as alternatives to other skin substitutes. The skin substitutes that were part of the evidence base for this report included Epifix, TheraSkin, TalyMed, and PriMatrix (Hayes, Skin Substitutes for Venous Leg Ulcers in Adults, 2020, Updated 202**3**~~1~~).

In a technical brief prepared for the Agency for Healthcare Research and Quality (AHRQ), Snyder et al. (2020) evaluated skin substitutes for treating chronic wounds. Systematic reviews/meta-analyses, ~~randomized controlled trials~~**RCTs** and prospective nonrandomized comparative studies examining commercially available skin substitutes in individuals with diabetic foot ulcers, venous leg ulcers, pressure ulcers, and arterial leg ulcers were included in the review. Seventy-six commercially available skin substitutes were identified and categorized based on the Davison-Kotler classification system. Sixty-eight (89%) were categorized as acellular dermal substitutes, mostly replacements from human placental membranes and animal tissue sources. Three systematic reviews and 22 RCTs examined use of 16 distinct skin substitutes, including acellular dermal substitutes, cellular dermal substitutes, and cellular epidermal and dermal substitutes in diabetic foot ulcers, pressure ulcers, and venous leg ulcers. Twenty-one ongoing clinical trials (all RCTs) examined an additional nine skin substitutes with comparable classifications. EpiFix was reviewed in five studies.

Grafix/GrafixPRIME, MatriStem Wound Matrix/MatriStem MicroMatrix, ~~Theraskin~~**TheraSkin** and ~~Dermacell~~**DermACELL** were all reviewed in two studies each. The findings of the review included the following:

- While 85 percent of studies examining acellular dermal substitutes described the experimental intervention as favorable over standard of care for wound healing and shorter time to heal, insufficient data are available to determine whether wound recurrence or other sequela are less frequent with acellular dermal substitutes. Only three studies compared cellular dermal substitutes with standard of care. Clinical evidence for cellular dermal substitutes may be limited by the lack of robust, well-controlled clinical trials of these products in this category.
- Of the six head-to-head comparative studies, findings from five studies did not indicate significant differences between skin substitutes in outcomes measured at the latest follow-up (> 12 weeks). The investigators concluded that the current evidence base may be insufficient to determine whether one skin substitute product is superior to another.
- The investigators found little information on the long-term effects of using skin substitutes. Wound recurrence was seldom reported, and potential toxic or carcinogenic effects are not known. Information on amputations and hospitalizations due to infections is also missing. Before findings can be relied upon, more data are needed on hospitalization, pain reduction, need for amputation, exudate and odor control, and return to baseline activities of daily living and function.
- The investigators indicated that variation in study designs reduces the ability to compare outcomes across studies. For example, the investigators identified 20 different criteria in 38 (published and ongoing) studies reporting wound size inclusion criterion. Sizes ranged from as small as 0.5 cm^2 to 100 cm^2. One to 25 cm^2 was the most common range used as a wound size inclusion criterion. More than 4 weeks was the most common wound duration inclusion criterion (25 studies), while a few studies allowed up to 52 weeks. Only six published studies reported on wound recurrence after 12 weeks. Given the variation in these and other study design features, the investigators indicated that research in this field may benefit from a more standardized study design.
- The investigators found that industry funded 20 of 22 RCTs included in this report, which raises significant concerns about possible publication bias or selective outcome reporting in that results unfavorable to industry may not be reported or published.

According to the investigators, the lack of studies examining the efficacy of most skin substitute products and the need for better designed studies providing more clinically relevant data are this Technical Brief's clearest implications. The investigators indicated that future studies may be improved by using a 4-week run-in period before study enrollment and at least a 12-week study period. Future studies should also report whether wounds recur during 6-month follow-up.

Skin and Soft Tissue Substitutes

ACApatch

Studies are lacking regarding the use of ACApatch for wound treatment. Therefore, it is not possible to conclude whether ACApatch has a beneficial effect on health outcomes.

ACApatch (RegenTX Partners LLC) is a dehydrated allograft composed of three-layers: two (2) amnion layers and one (1) chorion layer intended to act as a barrier and provides protective coverage from the surrounding environment to acute and chronic wounds.

Acesso

Studies are lacking regarding the use of Acesso for wound treatment. Therefore, it is not possible to conclude whether Acesso has a beneficial effect on health outcomes.

Acesso (Dynamic Medical Services LLC) is a sterile single layered human amniotic membrane intended to serve as a wound barrier or protective covering for acute and chronic wounds.

Acesso AC

Studies are lacking regarding the use of Acesso AC for wound treatment. Therefore, it is not possible to conclude whether Acesso AC has a beneficial effect on health outcomes.

Acesso AC (Dynamic Medical Services LLC) is a dual layer human amnion/chorion membrane that is intended to serve as a protective covering or barrier for acute and chronic wounds.

Acesso DL

Studies are lacking regarding the use of Acesso DL for wound treatment. Therefore, it is not possible to conclude whether Acesso DL has a beneficial effect on health outcomes.

Acesso DL (Dynamic Medical Services LLC, Surgenex) is a dehydrated dual layered human amniotic membrane allograft intended to serve as a barrier or cover for acute and chronic wounds.

Acesso TL

Studies are lacking regarding the use of Acesso TL for wound treatment. Therefore, it is not possible to conclude whether Acesso TL has a beneficial effect on health outcomes.

Acesso TL(Dynamic Medical Services LLC, Surgenex) is a dehydrated allograft derived from donated human placental birth tissue. Acesso TL Membrane is a triple layer amniotic membrane that is intended for use "over the wound" and "as a barrier" or "protective coverage…to acute and chronic wounds.

Activate Matrix

Studies are lacking regarding the use of Activate Matrix for wound treatment. Therefore, it is not possible to conclude whether Activate Matrix has a beneficial effect on health outcomes.

Activate Matrix consists of all three layers of the placental membranes including amnion, intermediate layer and chorion. It is a minimally manipulated human placental membrane product derived from donated placental tissues that retain the structural and functional characteristics of the tissues. The final product is dehydrated and composed of extracellular matrix proteins that serves as a natural, biological barrier or wound cover.

Affinity

There are few published studies addressing the use of Affinity. Therefore, it is not possible to conclude whether Affinity has a beneficial effect on health outcomes.

Affinity (Organogenesis Inc.) is a fluid membrane allograft that is intended for clinical use in wound repair and healing.

Refer to the above section titled Systematic Reviews, Meta-Analyses, Guidelines and Technology Assessments That Address Multiple Skin Substitutes for additional articles/reports that evaluate Affinity.

AlloGen

There are few published studies addressing the use of AlloGen. Therefore, it is not possible to conclude whether AlloGen has a beneficial effect on health outcomes.

AlloGen (~~Vivex Biomedical, Inc.)~~**VivexBiologics)** is ~~an~~ **a liquid matrix derived from** amniotic fluid ~~product derived from donated birth tissue.~~. AlloGen is intended **to act as a cushion to support joint capsules and other injured or traumatized tissues** for treatment of non-healing wounds and burn injuries.

alloPLY

Studies are lacking regarding the use of alloPLY for wound treatment. Therefore, it is not possible to conclude whether alloPLY has a beneficial effect on health outcomes.

alloPLY (RegenTX Partners LLC) is a dehydrated dual-layer epithelium/basement membrane allograft that retains the amniotic membrane's key structural components related to its utility to serve as a barrier. alloPLY is intended to be used as a wound cover and barrier.

AlloSkin

There are few published studies addressing the use of AlloSkin. Therefore, it is not possible to conclude whether AlloSkin has a beneficial effect on health outcomes.

AlloSkin (AlloSource) is a meshed human allograft skin for acute and chronic wound therapy. It is comprised of cadaveric epidermis and dermis.

Moravvej et al. (2016) evaluated allogeneic fibroblasts on meshed split thickness skin grafts (STSGs) in 14 ~~patients~~**individuals**. After debridement and wound excision, meshed STSG was used to cover the entire wound. AlloSkin (all fibroblasts cultured on a combination of silicone and glycosaminoglycan) was applied on one side and petroleum jelly-impregnated gauze (Iran Polymer and Petrochemical Institute) was applied on the other. The healing time, scar formation, and pigmentation score were assessed for the ~~patients~~**individuals**. AlloSkin demonstrated good properties compared to petroleum jelly-impregnated gauze. The average healing time **(8.8 days) compared to the petroleum jelly group (13.6 days)** and hypertrophic scar formation were significantly different between the two groups. **The difference in scar formation became insignificant after 12 months** In addition, the skin pigmentation score in the AlloSkin group was closer to normal. The authors concluded that AlloSkin grafting, including fibroblasts on meshed STSG, may be a useful method to reduce healing time and scar size and may require less autologous STSG in extensive burns where a high percentage of skin is burned and there is a lack of available donor sites. Larger prospective, controlled clinical studies are needed to compare the effectiveness, of human skin allograft to standard care.

AlloWrap

There are few published studies addressing the use of AlloWrap. Therefore, it is not possible to conclude whether AlloWrap has a beneficial effect on health outcomes.

AlloWrap (AlloSource) is a human amniotic membrane designed to provide a biologic barrier following surgical repair.

AmchoPlast

Studies are lacking regarding the use of AmchoPlast for wound treatment. Therefore, it is not possible to conclude whether AmchoPlast has a beneficial effect on health outcomes.

AmchoPlast (RMBB Health) is a minimally manipulated, dehydrated, human amnion/chorion membrane allograft intended for use as a protective barrier and cover that offers protection from the surrounding environment in repair and reconstruction procedures.

American Amnion, American Amnion AC™ and Amnion AC Tri-Layer

Studies are lacking that address the use of American Amnion™, American Amnion AC™ and Amnion AC Tri-Layer™. Therefore, it is not possible to conclude whether American Amnion™, American Amnion AC™ and/or Amnion AC Tri-Layer™ have a beneficial effect on health outcomes.

American Amnion™ (BioStem Technologies) is a decellularized human amniotic allograft product derived from placental tissues are sterilized by e-beam irradiation. American Amnion™ is intended for use as a protective covering for soft tissue wounds.

American Amnion AC™ (BioStem Technologies) is a decellularized human amniotic and chorionic allograft product derived from placental tissues are sterilized by ebeam irradiation. American Amnion AC™ is intended for use as a protective covering for soft tissue wounds.

Amnion AC Tri-Layer™ (BioStem Technologies) is a decellularized human amniotic, intermediate, and chorionic allograft product derived from placental tissues are sterilized by e-beam irradiation. Amnion AC Tri-Layer is intended for use as a protective covering for soft tissue wounds.

AmniCore Pro

Studies are lacking regarding the use of AmniCore Pro for wound treatment. Therefore, it is not possible to conclude whether AmniCore Pro has a beneficial effect on health outcomes.

AmniCore Pro (Stability Biologics) is comprised of donated human tissue that has been screened, recovered and serologically/microbiologically tested at Certified Laboratory Improvement Amendments (CLIA) certified labs in adherence with Food and Drug Administration (FDA), State and American Association of Tissue Banks (AATB) requirements. AmnioCore Pro is a significantly different allograft compared to all other AmnioCore brands. AmnioCore Pro is unique in that it is comprised of amniotic membrane and chorionic membrane, whereas all other AmnioCore brands are comprised of only amnionic membranes. The AmnioCore Pro is a dual layer allograft with an amnion inferior surface and a chorion superior surface.

AmniCore Pro+

Studies are lacking regarding the use of AmniCore Pro+ for wound treatment. Therefore, it is not possible to conclude whether AmniCore Pro+ has a beneficial effect on health outcomes.

AmniCore Pro+ (Stability Biologics) is comprised of donated human tissue that has been screened, recovered and serologically/microbiologically tested at Certified Laboratory Improvement Amendments (CLIA) certified labs in adherence with Food and Drug Administration (FDA), State and American Association of Tissue Banks (AATB) requirements. AmnioCore Pro+ is an exclusive and bioactive allograft different from AmnioCore Pro and other AmnioCore brands. The AmnioCore Pro+ is a three-layer allograft comprised of amniotic membrane and chorionic membrane, whereas AmnioCore Pro is a dual layer amnion/chorion graft all the other AmnioCore brands are comprised of only amnionic membranes. The AmnioCore Pro+ is a three-layer allograft with an amnion inferior surface, chorion inner layer, and an amnion superior surface.

AmnioTX

Studies are lacking regarding the use of AmnioTX for wound treatment. Therefore, it is not possible to conclude whether AmnioTX has a beneficial effect on health outcomes.

AmnioTX (RegenTX Partners LLC) is a dehydrated dual layer amniotic membrane protective wound covering that is intended to be used as a barrier that protects wounds.

Amnio Quad-Core

Studies are lacking regarding the use of Amnio Quad-Core for wound treatment. Therefore, it is not possible to conclude whether Amnio Quad-Core has a beneficial effect on health outcomes.

Amnio Quad-Core (Stability Biologics is comprised of donated human tissue that has been screened, recovered and serologically/microbiologically tested at Certified Laboratory Improvement Amendments (CLIA) certified labs in adherence with Food and Drug Administration (FDA), State and American Association of Tissue Banks (AATB) requirements. Amnio Quad-Core is a four-layer allogeneic amniotic membrane allograft for use as a barrier and applied as a single use covering.

Amnio Tri-Core Amniotic

Studies are lacking regarding the use of Amnio Tri-Core Amniotic for wound treatment. Therefore, it is not possible to conclude whether Amnio Tri-Core Amniotic has a beneficial effect on health outcomes.

Amnio Tri-Core Amniotic (Stability Biologics) is a three-layer allogeneic amniotic membrane allograft for use as a barrier and applied as a covering.

AmnioAmp-MP

There are few published studies addressing the use of AmnioAmp-MP. Therefore, it is not possible to conclude whether AmnioAmp-MP has a beneficial effect on health outcomes.

AmnioAmp-MP (CellGenuity Regenerative Science) amniotic membrane is a sterile human tissue allograft membrane patch intended for homologous use to cover and protect a recipient's tissue to be used for acute and chronic wounds, barrier to enhance soft tissue healing after a primary surgical repair and general reconstructive surgery to reduce scar tissue formation and enhance soft tissue healing.

Amnio Wound

There are few published studies addressing the use of Amnio Wound. Therefore, it is not possible to conclude whether Amnio Wound has a beneficial effect on health outcomes.

Amnio Wound (Alpha Tissue, LLC) is a lyophilized human amniotic membrane allograft comprised of an epithelial layer and two fibrous connective tissue layers specifically processed to be used for the repair and replacement of lost or damaged dermal tissue.

AmnioWrap2

There are few published studies addressing the use of Amnio Wrap2. Therefore, it is not possible to conclude whether AmnioWrap2 has a beneficial effect on health outcomes.

AmnioWrap2 (Direct Biologics™) is a placental-based allograft comprised of unseparated amnion and chorion membranes including the intact intermediate layer. It is indicated as a protective covering when placed over a wound bed or surgical site and provides the key components found in human placental tissues including an intact extracellular matrix (ECM), growth factors and cytokines.

AmnioArmor

There are few published studies addressing the use of AmnioArmor. Therefore, it is not possible to conclude whether AmnioArmor has a beneficial effect on health outcomes.

AmnioArmor (Bone Bank Allografts, a subsidiary of Globus Medical, Inc.) is a dehydrated human amniotic membrane allograft derived from placental tissue submucosa. It is intended as a wound covering for acute and chronic wounds.

AmnioBand Viable Membrane and Guardian

There is insufficient evidence to support the use of AmnioBand Viable Membrane and Guardian due to study limitations. Larger studies are needed to establish safety, efficacy and long-term outcomes.

AmnioBand and Guardian (MTF Biologics) are human tissue allografts made of donated placental membrane. Although marketed under two different brand names, the products are identical.

Refer to the above section titled Systematic Reviews, Meta-Analyses, Guidelines and Technology Assessments That Address Multiple Skin Substitutes for additional articles/reports that evaluate AmnioBand.

In a multicenter RCT, Serena et al. (2022) evaluated the safety and effectiveness of weekly and biweekly applications of AmnioBand, a dehydrated human amnion and chorion allograft (dHACA), plus standard of care (SOC) compared to SOC alone on chronic venous leg ulcers. This study included individuals with chronic venous leg ulcers at eight wound care centers across the United States. The main endpoint was the number of healed ulcers at 12 weeks. Secondary endpoints included the number of ulcers achieving 40 percent closure at 4 weeks along with any adverse effects. SOC included cleaning and debriding of the ulcer, application of multilayer compression bandaging, and instructions to keep leg elevated and bandage dry. Inclusion criteria included: age ≥ 18 years; ankle brachial index (ABI) >0.75 or skin perfusion pressure (SPP) >30 mmHg or transcutaneous oximetry measurement (TCOM) >30 mmHg; VLU wound area ≤ 2 cm2 but < 20 cm2 of a duration longer than one month that extended through the full thickness of the skin but not down to the muscle, tendon, or bone; study ulcer with a clean, granulating base with minimal adherent slough and treated with compression therapy for a minimum of 14 days prior to randomization. Individuals were excluded if the ulcer was infected, suspicious for cancer, caused by a condition other than venous insufficiency, required treated by negative-pressure wound

therapy or hyperbaric oxygen therapy or had previously been treated with cellular and/or tissue-based products. Individuals were also excluded if they had a history of HIV/AIDS, drug or alcohol abuse, radiation therapy at the ulcer site, ulcers on the dorsum of the foot or with ≥ 50% of the ulcer below the malleolus, pregnant or breastfeeding, diabetes with HbA1c >12.0 within the past 90 days, renal dysfunction with serum creatinine levels ≥ 3.0 mg/dl within the last 90 days, used tobacco within the last 30 days or had a history of liver disease with active cirrhosis. Out of 101 individuals screened, the results included 60 individuals were eligible and enrolled with 20 subjects randomized to each group. At 12 weeks, significantly more venous leg ulcers healed in the two dHACA-treated groups (75 percent) than in the standard-of-care group (30 percent) (p = 0.001) even after adjustment for wound area (p = 0.002), with an odds ratio of 8.7 (95 percent CI, 2.2 to 33.6). There were no significant differences in the proportion of wounds with percentage area reduction greater than or equal to 40 percent at 4 weeks among all groups. The adverse event rate was 63.5 percent. Among the 38 adverse events, none were graft or procedure related, and all were resolved with appropriate treatment. Limitations included lack of blinding and short-term follow-up. The manufacturer assisted with funding of this study. In conclusion, dHACA and standard of care, regardless of frequency (weekly or biweekly), healed approximately 45% more venous leg ulcers than standard of care alone. The authors indicate that the use of dHACA should be considered as an adjunct to standard of care of nonhealing venous leg ulcers.

AmnioBind or DermaBind TL

There are ~~no~~ **few** published studies addressing the use of AmnioBind or DermaBind TL for wound treatment. Therefore, it is not possible to conclude whether AmnioBind or DermaBind TL has a beneficial effect on health outcomes.

AmnioBind few~~or~~ DermaBind TL is a terminally sterilized, dehydrated, full thickness placental membrane (PM) allograft consisting of amnion, chorion, and the associated intermediate (spongy) layer used to treat acute and chronic wounds.

AmnioCore TM

There are **few** ~~no~~ published studies addressing the use of AmnioCore TM for wound treatment. Therefore, it is not possible to conclude whether AmnioCore TM has a beneficial effect on health outcomes.

AmnioCore™ (Stability Biologics) is a dual layer amniotic tissue allograft used to reduce scar tissue formation and modulate inflammation with natural barrier properties to enhance healing.

Amniocyte Plus

There are **few** ~~no~~ published studies addressing the use of Amniocyte Plus for wound treatment. Therefore, it is not possible to conclude whether Amniocyte Plus has a beneficial effect on health outcomes.

Amniocyte Plus (Predictive Biotech) is a minimally manipulated amniotic fluid allograft. It is intended for use in repair, reconstruction, replacement or supplementation of a recipient's cells or tissue.

AMNIOEXCEL, AMNIOEXCEL Plus, or BioDExcel

There is insufficient evidence to support the use of AMNIOEXCEL, AMNIOEXCEL Plus, or BioDExcel due to study limitations. Larger studies are needed to establish safety, efficacy and long-term outcomes.

AMNIOEXCEL, also marketed under trade name BioDExcel, (Integra LifeSciences, Inc.) is a dehydrated human amnion-derived tissue allograft with intact extracellular matrix that is intended to advance soft tissue repair, replacement and reconstruction.

AMNIOEXCEL Plus is an extension of the AMNIOEXCEL and BioDExcel product line that incorporates additional layers of human-sourced amnion and chorion.

Refer to the above section titled Systematic Reviews, Meta-Analyses, Guidelines and Technology Assessments That Address Multiple Skin Substitutes for additional articles/reports that evaluate AMNIOEXCEL.

An ECRI report for AMNIOEXCEL (Integra LifeSciences) for dressing wounds and repairing soft-tissue defects indicates that the evidence for AMNIOEXCEL is inconclusive. The studies reviewed had major limitations which resulted in a high risk of bias. Therefore, the evidence is inconclusive (2019).

AmnioFix

There is insufficient evidence to support the use of AmnioFix due to study limitations. Larger studies are needed to establish safety, efficacy and long-term outcomes.

AmnioFix (MiMedx Group, Inc.) is a composite amniotic tissue membrane minimally manipulated to protect the collagen matrix and its natural properties. It is available in sheet/membrane, particulate, and wrap configurations for use in surgical (e.g., spinal fusion and discectomy), soft tissue, tendon, and nerve applications. Other AmnioFix products include AmnioFix Injectable that is intended for treatment of tendon and soft tissue injuries.

An ECRI report for AmnioFill and AmnioFix Allografts (MiMedx) for Use in Orthopedic Procedures indicates that the evidence is somewhat favorable for AmnioFix. Two ~~randomized controlled trial (~~RCT~~)~~ and three cases series shows that micronized AmnioFix injection is safe, relieves pain and improved function up to 3 months in ~~patients~~**individuals** with tendinopathies and arthritis. The RCTs were related to plantar fasciitis with three case series were related to arthritis and tendinosis. While the evidence is favorable for AmnioFix, larger RCTs are needed to validate results and assess long term outcomes. There were no studies evaluating AmnioFill in orthopedic procedures [ECRI AmnioFill and AmnioFix Allografts (MiMedx) for Use in Orthopedic Procedures, 2020].

An ECRI report for AmnioFix Amnion/Chorion Membrane Allograft (MiMedx) for Treating Surgical Wounds indicates that the evidence for AmnioFix is inconclusive. ~~Randomized controlled trials~~**RCTs** comparing AmnioFix with other skin substitutes and reporting on ~~patient~~ **individual** outcomes (e.g., complete wound healing, quality of life) are warranted to determine the efficacy of AmnioFix [ECRI AmnioFix Amnion/Chorion Membrane Allograft (MiMedx) for Treating Surgical Wounds, 2019].

A Hayes report for Human Amniotic Membrane (HAM) Injections for Treatment of Chronic Plantar Fasciitis indicates that a low-quality body of evidence suggests that HAM injections may result in pain relief and improved function. None of the studies reviewed by Hayes evaluated the comparative effectiveness of amniotic tissue–derived treatments compared with other types of injections such as platelet-rich plasma or botulinum toxin, extracorporeal shockwave therapy, or surgery. Substantial uncertainty remains regarding the comparative effectiveness. The studies included for review had limited follow-up of 12 weeks or less, making it difficult to assess the long-term effects of this treatment. Double-blind RCTs with active treatment comparators (injectables, surgery, extracorporeal shockwave therapy) are needed to evaluate the effectiveness and safety of amniotic tissue–derived allograft treatments for plantar fasciitis. The products evaluated in this report included PalinGen Sport FLOW, Clarix FLO, and AmnioFix (Hayes, 2019, updated 2021).

Cazzell et al. (2018) conducted a prospective, single-blind, randomized controlled trial at 14 sites in the United States to evaluate the efficacy of micronized dehydrated human amnion/chorion membrane (dHACM) injection for plantar fasciitis (PF). Subjects were randomized to receive 1 injection, in the affected area, of micronized dHACM (AmnioFix Injectable, MiMedx Group Inc.) (n = 73) or 0.9% sodium chloride placebo (n = 72). Baseline visual analog scale (VAS) scores were similar between groups. At the 3-month follow-up, mean VAS scores in the treatment group were 76% lower compared with a 45% reduction for controls, Foot Function Index-Revised (FFI-R) scores for treatment subjects had mean reduction of 60% versus baseline, whereas control subjects had mean reduction of 40% versus baseline. Of 4 serious adverse events, none were related to study procedures. The authors concluded that pain reduction and functional improvement outcomes were statistically significant and clinically relevant, supporting use of micronized dHACM injection as a safe and effective treatment for plantar fasciitis. The authors indicated that the study's results are limited as the comparative group received placebo injection; thus, the effectiveness of micronized dHACM allograft versus other advanced therapies cannot be determined. The study is also limited by a short follow-up time.

Ogaya-Pinies et al. (2018; reviewed in the ECRI report above) evaluated if the use of dehydrated human amnion/chorion membrane (dHACM) allograft wrapped around the neurovascular bundles (NVB) during a robotic-assisted radical prostatectomy (RARP) accelerates the return to potency. A total of 940 ~~patients~~ **individuals** with preoperative Sexual Health Inventory for Men (SHIM) > 20 underwent RARP with some degree of bilateral nerve sparing (NS). Of these, 235

~~patients~~ **individuals** underwent RARP, with bilateral placement of dHACM graft around the NVBs. They were matched in a 1:3 proportion with a similar group of ~~patients~~ **individuals** (n = 705) who did not receive the allograft (control group or group 2). Minimum follow-up was 12 months. Postoperative outcomes were analyzed between propensity-matched dHACM graft (group 1) and non-graft groups (group 2). There were no significant demographic differences between the two groups. Potency was defined as the ability to achieve and maintain satisfactory erections firm enough for sexual intercourse, with or without the use of PDE-5 inhibitors. The mean time to potency was significantly lower in group 1 (2.37 months) versus group 2 (3.94 months). The potency recovery rates were superior for group 1 at all early time points measured except at 12 months. ~~Patients~~ **Individuals** who received the dHACM wrap around the NVB after RARP accelerates the return to potency when compared to a similar control group without the use of the allograft. We also demonstrated that this faster return to potency occurs regardless of the degree of the NS preservation. Younger ~~patients~~**individuals** (< 55 years of age) had the highest overall advantage if they received the graft. The authors concluded that their results indicate that dHACM placement at the site of the prostatic NVB does not increase the risk of biochemical recurrence after RARP, neither in the presence of positive surgical margin, extra-prostatic disease nor high Gleason score. However, potency recovery rates did not differ between groups at 12-months post-RARP.

In a Systematic review and network meta-analysis, Tsikopoulos et al. (2016) compared the efficacy of different injection therapies for plantar fasciopathy (historically known as 'plantar fasciitis'). Randomized trials comparing various injection therapies in adults with plantar fasciopathy were included. The primary outcome was pain relief. Secondary outcomes included functional disability, composite and health-related outcomes. All outcomes were assessed (1) in the short term (up to 2 months), (2) the intermediate term (2-6 months) and (3) the medium term (more than 6 months to 2 years). Quality assessment was performed using the Cochrane risk of bias tool. Twenty-two trials comprising 1,216 ~~patients~~ **individuals** were included in the review. Dehydrated amniotic membrane injections were significantly superior to corticosteroids in the short term in achieving the primary and composite outcomes. The authors concluded that although the dehydrated amniotic membrane provided significant clinical relief at 0-2 months, there were no data about this treatment at 2 months and beyond.

Zelen et al. (2013a) reported the results of a randomized clinical trial examining the efficacy of micronized dehydrated human amniotic/chorionic membrane (mDHACM) injection as a treatment for chronic refractory plantar fasciitis. Forty-five ~~patients~~ **individuals** were randomized to receive injection of 2 cc 0.5% Marcaine plain, then either 1.25 cc saline (controls), 0.5 cc mDHACM, or 1.25 cc mDHACM. Follow-up visits occurred over 8 weeks to measure function, pain, and functional health and well-being. Significant improvement in plantar fasciitis symptoms was observed in ~~patients~~ **individuals** receiving 0.5 cc or 1.25 cc mDHACM versus controls within 1 week of treatment and throughout the study period. The authors concluded that in ~~patients~~ **individuals** with refractory plantar fasciitis, mDHACM is a viable treatment option. According to the authors, larger studies are needed to confirm these findings.

AMNIOMATRIX or BioDMatrix

There are few published studies addressing the use of AMNIOMATRIX or BioDMatrix. Therefore, it is not possible to conclude whether AMNIOMATRIX or BioDMatrix has a beneficial effect on health outcomes.

AMNIOMATRIX, also marketed under the trade name BioDMatrix, (Integra Lifesciences Corporation) is a viable human placental allograft composed of morselized amniotic membrane and amniotic fluid components recovered from the same human donor. AMNIOMATRIX may be mixed with normal saline for application to surgical sites and open, complex or chronic wounds or mixed with the recipient's blood to fill soft tissue defects.

Amnio-Maxx and Amnio-Maxx Lite

There are **few** ~~no~~ published studies addressing the use of Amnio-Maxx or Amnio-Maxx Lite for wound treatment. Therefore, it is not possible to conclude whether Amnio-Maxx or Amnio-Maxx Lite has a beneficial effect on health outcomes.

Amnio-Maxx (Royal Biologics) is a dehydrated, amniotic tissue membrane graft. The dual layer patch is used for chronic, non-healing wounds such as venous leg ulcers or soft tissue defects. The Amnio-Maxx Lite version is a single layer.

AmnioPlast 1 or AmnioPlast 2

There are few published studies addressing the use of *AmnioPlast 1 or AmnioPlast 2* for wound treatment. Therefore, it is not possible to conclude whether *AmnioPlast 1 or AmnioPlast 2* have a beneficial effect on health outcomes.

AmnioPlast 1™ (LifeCell International Pvt Ltd) is a minimally manipulated, sterile, dehydrated monolayered human amnion membrane allograft for homologous use. It is intended to be used as a protective barrier and cover that offers protection from surrounding environment in repair or reconstruction procedures of ocular diseases and/or abnormalities.

AmnioPlast 2™ (LifeCell International Pvt Ltd) is a sterile, minimally manipulated, non-viable cellular amnion chorion membrane allograft for homologous use. It is intended to be used as a protective barrier and cover that offers protection from the surrounding environment in repair or reconstruction procedures of ocular diseases and/or abnormalities.

AMNIOREPAIR or AltiPly

~~There are no published~~ **There are few published** studies addressing the use of AMNIOREPAIR or AltiPly for wound treatment. Therefore, it is not possible to conclude whether AMNIOREPAIR or AltiPly have a beneficial effect on health outcomes.

AMNIOREPAIR and AltiPly (Aziyo Biologics) are human cellular and tissue-based products. They are lyophilized placental membrane allografts indicated for use as a biological barrier or wound cover, forming a protective cover for a variety of acute and chronic wounds.

Amniotext

~~There are no published~~ **There are few published** studies addressing the use of Amniotext for wound treatment. Therefore, it is not possible to conclude whether Amniotext has a beneficial effect on health outcomes.

Amniotext (Regenerative Labs) is an amniotic membrane derived, human tissue allograft suspension product. It is intended to serve as a barrier to aid in the repair and healing of a defect.

Amniotext Patch

~~There are no published~~ **There are few published** studies addressing the use of an Amniotext Patch for wound treatment. Therefore, it is not possible to conclude whether Amniotext Patch has a beneficial effect on health outcomes.

Amniotext Patch (Regenerative Labs) is an amniotic membrane-derived, human tissue allograft. The product serves as a wound covering and is intended for chronic non-healing wounds such as venous leg ulcers.

Amnion Bio

There are few published studies addressing the use of Amnion Bio for wound treatment. Therefore, it is not possible to conclude whether Amnion Bio has a beneficial effect on health outcomes.

The product information for Amnion Bio (Axolotl Biologix, Inc.) is not currently available.

AMNIPLY

There are few published studies addressing the use of AMNIPLY. Therefore, it is not possible to conclude whether AMNIPLY has a beneficial effect on health outcomes.

The product information on AMNIPLY is not currently available.

Apis

There are few published studies addressing the use of Apis. Therefore, it is not possible to conclude whether Apis has a beneficial effect on health outcomes.

Apis **(SweetBio, Inc)** is an absorbable, biodegradable skin substitute comprised of gelatin (porcine derived), Manuka honey, and hydroxyapatite **bioengineered to protect wounds, manage exudate, and maintain a moist environment**. Skin substitutes are used to protect large or nonhealing wounds or burns.

Architect

There are few published studies addressing the use of Architect extracellular matrix for wound treatment. Therefore, it is not possible to conclude whether Architect extracellular matrix has a beneficial effect on health outcomes.

Architect (Harbor MedTech, Inc) is a sterile, extracellular equine derived collagen matrix (ECM) that is intended to treat partial or full thickness skin wounds.

ArdeoGraft

Studies are lacking regarding the use of ArdeoGraft for wound treatment. Therefore, it is not possible to conclude whether ArdeoGraft has a beneficial effect on health outcomes.

ArdeoGraft (Surgenex) is a dehydrated dual layer human chorionic membrane allograft which is intended to act as a barrier and provides protective coverage to acute and chronic wounds.

Artacent AC, Artacent C, Artacent Trident, Artacent Velos, Artacent Vericlen or Artacent Wound~~Artacent~~

There are few published studies addressing the use of **Artacent C, Artacent AC, Artacent Trident, Artacent Velos, Artacent Vericlen or Artacent Wound** ~~Artacent~~ for wound treatment. Therefore, it is not possible to conclude whether **Artacent C, Artacent AC, Artacent Trident, Artacent Velos, Artacent Vericlen or Artacent Wound** ~~Artacent~~ has a beneficial effect on health outcomes.

Artacent Wound (Tides Medical) is a wound specific amniotic patch. It is derived from the submucosa of donated human placenta, and it consists of collagen layers, including basement membrane and stromal matrix. According to the manufacturer, it is indicated for diabetic ulcers, pressure ulcers, venous stasis ulcers and burns.

Artacent AC (Tides Medical) is a dehydrated, micronized choriamniotic membrane powder that is intended for acute and chronic wound applications including diabetic ulcers, pressure ulcers, venous stasis ulcers, and burns that are refractory to more conservative treatment.

Artacent C (Tides Medical) is a dehydrated, sterilized, human amniotic allograft (single layer chorion membrane) intended for use as a protective wound covering for acute and chronic wounds.

Artacent Trident (Tides Medical) is a dehydrated, sterilized, triple layer human amniotic membrane allograft intended for use as a wound covering for acute and chronic wounds.

Artacent VeriClen (Tides Medical) is a single use, dehydrated, sterilized, human amnion-chorion membrane allograft intended for use as a wound covering for acute and chronic wounds

Artacent Cord

There are few published studies addressing the use of Artacent Cord. Therefore, it is not possible to conclude whether Artacent Cord has a beneficial effect on health outcomes.

Artacent Cord (Tides Medical) is a wound healing patch that is comprised of the umbilical cord. It is intended for the treatment of acute and chronic wounds such as diabetic ulcers, venous stasis ulcers, and burns.

ArthroFLEX

There is insufficient evidence to support the use of ArthroFLEX due to study limitations. Larger studies are needed to establish safety, efficacy and long-term outcomes

ArthroFLEX (Arthrex®) is an acellular dermal matrix intended for supplemental support and covering for soft-tissue repair.

An ECRI report for ArthroFLEX indicated that evidence from 3 small studies is at too high a risk of bias to determine how well it repairs rotator cuff tears. Studies suggest that ArthroFLEX is safe, and 1 study suggests ArthroFLEX may improve 2-year outcomes of arthroscopic repair. However, findings need validation in multicenter RCTs that report long-term outcomes [ECRI, ArthroFLEX Acellular Dermal Matrix (LifeNet Health and Arthrex, Inc.) for Repairing Large to Massive Rotator Cuff Tears 2017, updated 2022].

Ascent

There are few published studies addressing the use of Ascent. Therefore, it is not possible to conclude whether Ascent has a beneficial effect on health outcomes.

Ascent (StimLabs, LLC) is a dehydrated cell and protein concentrate injectable derived from human amniotic fluid. It is intended for treating non-healing wounds and burns.

*Axo**b**~~B~~ioMembrane*

There are few published studies addressing the use of Axo**b**~~B~~ioMembrane. Therefore, it is not possible to conclude whether Axo**b**~~B~~ioMembrane has a beneficial effect on health outcomes.

Axo**b**~~B~~ioMembrane (Axolotl Biologix, Inc.) is a dehydrated human amniotic membrane allograft that is intended to accelerate and improve soft tissue repair.

Axolotl Ambient and Axolotl Cryo

There are few published studies addressing the use of Axolotl Ambient or Axolotl Cryo. Therefore, it is not possible to conclude whether these products have a beneficial effect on health outcomes.

Axolotl Ambient and Axolotl Cryo (Axolotl Biologix, Inc.) are human amniotic flowable allografts. These products are intended to support the repair of soft tissue injury.

Axolotl Graft or Axolotl DualGraft

There are few published studies addressing the use of Axolotl Graft and Axolotl DualGraft. Therefore, it is not possible to conclude whether these products have a beneficial effect on health outcomes.

Axolotl Graft and Axolotl DualGraft (Axolotl Biologix, Inc.) are human amniotic allograft, decellularized, dehydrated placental membrane intended to be used for the repair or regeneration of damaged or diseased tissues.

Barrera SL or Barrera DL

There are few published studies addressing the use of Barrera SL or Barrera DL. Therefore, it is not possible to conclude whether Barrera SL or Barrera DL has a beneficial effect on health outcomes.

Barrera SL and Barrera DL (RegenTx Partners) is a dehydrated amniotic allograft. It is intended to serve as a protective wound cover to offer protection from the surrounding environment in wounds, including surgically created wounds.

BellaCell HD

There are few published studies addressing the use of BellaCell. Therefore, it is not possible to conclude whether BellaCell has a beneficial effect on health outcomes.

BellaCell (HansBiomed Corp.) is a human acellular dehydrated dermis regenerative tissue matrix. It is intended for use in skin reconstruction to repair skin loss from injuries and wounds.

bio-ConneKt

There are few published studies addressing the use of bio-ConnecKt for wound treatment. Therefore, it is not possible to conclude whether bio-ConnecKt has a beneficial effect on health outcomes.

The bio-ConneKt Wound Matrix (MLM Biologics, Inc.) is a wound dressing used for moderately to heavily exuding wounds and ulcers. It is made of reconstituted collagen derived from equine tendon.

BioDfence or BioDfence DryFlex

There are few published studies addressing the use of BioDfence or BioDfence DryFlex. Therefore, it is not possible to conclude whether BioDfence or BioDfence DryFlex has a beneficial effect on health outcomes.

BioDfence and BioDfence DryFlex (BioD, LLC) are membrane allografts derived from the human placental tissues for use as a tissue barrier that covers and protects the underlying tissues.

Bioskin

There are few published studies addressing the use of Bioskin for wound treatment. Therefore, it is not possible to conclude whether Bioskin has a beneficial effect on health outcomes.

Bioskin (Wright Medical Group, N.V.) is an amniotic wound matrix intended to support challenging would care treatment and cover and protect acute and chronic wounds.

Bioskin Flow

There are few published studies addressing the use of Bioskin Flow for wound treatment. Therefore, it is not possible to conclude whether Bioskin Flow has a beneficial effect on health outcomes.

The product information on Bioskin Flow is not currently available.

Biovance, Biovance Tri-Layer, or Biovance 3L

There are few published studies addressing the use of Biovance, Biovance Tri-Layer or Biovance 3L. Therefore, it is not possible to conclude whether Biovance, Biovance Tri-Layer or Biovance 3L has a beneficial effect on health outcomes.

Biovance (Celularity) is a is an amniotic membrane allograft derived from the placenta of a healthy, full-term human pregnancy, intended for the treatment of acute and chronic wounds including burns, diabetic ulcer, pressure ulcers and surgical wounds.

Biovance 3L is a triple-layer decellularized, dehydrated human amniotic membrane, sterilized using e-beam irradiation. Biovance 3L is intended to be used as a cover or to protect from the surrounding environment in wound and surgical repair and reconstruction procedures.

An ECRI report for Biovance Amniotic Membrane Allograft (Celularity, Inc.) for treating chronic wounds indicates that the evidence for Biovance is inconclusive. The studies reviewed were very low-quality single arm studies that had major limitations which resulted in a high risk of bias. Therefore, the evidence is inconclusive [ECRI Institute. Product Brief. Biovance Amniotic Membrane Allograft (Celularity, Inc.) for Treating Chronic Wounds. Plymouth Meeting (PA): ECRI Institute; July 2020].

In a 2020 ECRI clinical evidence assessment, it was concluded that based on two very low-quality single arm studies, the efficacy of Biovance for the treating chronic wounds compared to standard of care and other skin grafts cannot be determined. Both studies had a high risk of bias due to four or more limitations, including small study size, incomplete outcomes reporting, and lack of controls, randomization, and blinding. Studies did not report on some key **individual** ~~patient~~ -oriented outcomes (e.g., infection, quality of life, wound size reduction). The studies assessed ~~patients~~ ~~individuals~~ with different wound etiologies and different wound types, resulting in the results not generalizable across all

~~patients~~ **individuals** or wound types. The pilot trial does not report outcomes for wound types separately (i.e., venous leg ulcers, pressure ulcers, arterial ulcers, and collagen vascular disease associated ulcers).

Smiell et al. (2015) conducted a multicenter registry study to observe outcomes with use of a decellularized, dehydrated human amniotic membrane (DDHAM; Biovance) in uninfected, full-thickness, or partial-thickness wounds. Investigators were instructed to provide usual care regarding visit and application frequencies, concomitant therapies, and change in wound-care regimens. The only exclusions were ~~patients~~ **individuals** with actively infected wounds or known hypersensitivity to DDHAM. Fifteen sites with practicing wound care clinicians of various specialties participated in this review, enrolling chronic wounds including venous, diabetic, pressure, collagen vascular, and arterial ulcers-all of various severities, durations, sizes, and previous treatments. A total of 244 wounds were observed in this study, however, this review is limited to the 179 chronic wounds in 165 ~~patients~~ **individuals** that were enrolled at 15 of the 19 participating centers. The 4 centers that enrolled acute wounds only were excluded. Results from the analysis of this very heterogeneous population demonstrated that during the usual course of an average of 8 weeks of wound management, ~~patients~~ **individuals** experienced factors that significantly affected wound closure. These factors included wound infections, noncompliance with prescribed treatments (e.g., compression, off-loading, and wound care), re-injury of the wound, and systemic comorbidities. Nearly 50% of chronic wounds (including those that failed previous therapy with advanced biologics) with an average baseline area of 3.1 cm2 achieved complete closure within a median of 6.3 weeks without product-related adverse experiences. The authors concluded that this registry study demonstrated the safety and clinical benefit of DDHAM to support wound closure across a variety of chronic wound types and **individual** ~~patient~~ conditions in real-world environments. The authors recommended that these findings be validated in a prospective randomized controlled trial in chronic wounds with stricter enrollment criteria and monitoring of a standard of good wound care.

BioWound, BioWound Plus, and BioWound Xplus

There are few published studies addressing the use of BioWound, BioWound Plus, and BioWound Xplus. Therefore, it is not possible to conclude whether these products have a beneficial effect on health outcomes.

BioWound, BioWound Plus, and BioWound Xplus (Human Regenerative Technologies, LLC) are single-layer wound coverings for wounds. These products are intended for use as a wound covering, surgical covering, or wrap or barrier in acute and chronic wounds.

CaregraFT

Studies are lacking regarding the use of CaregraFT for wound treatment. Therefore, it is not possible to conclude whether CaregraFT has a beneficial effect on health outcomes.

CaregraFT **(RegenTX Partners LLC)** is a dehydrated amnion and chorion membrane allograft that is intended to act as a barrier and provides protective coverage from the surrounding environment to acute and chronic wounds.

CarePATCH™

There are few published studies addressing the use of CarePATCH™. Therefore, it is not possible to conclude whether CarePATCH™ has a beneficial effect on health outcomes.

CarePATCH™ (Extremity Care) is a dehydrated human amniotic membrane allograft intended to be used as a wound cover or protective wound barrier.. Processed following aseptic techniques to preserve the native physical integrity, tensile strength, and elasticity characteristics of the amnion.

Celera Dual Layer or Celera Dual Membrane

~~There are no published~~ **There are few published** studies addressing the use of Celera Dual Layer or Celera Dual Membrane for wound treatment. Therefore, it is not possible to conclude whether Celera Dual Layer or Celera Dual Membrane has beneficial effect on health outcomes.

Celera™ Dual Membrane and Celera™ Dual Layer (Nvision Biomedical Technologies, Inc.) ~~is an Extracellular Matrix (ECM)~~ are products that are minimally manipulated human amniotic and/or chorionic membrane products derived from

placental tissues that retain the structural and functional characteristics of the tissues. These products are intended to serve as a wound cover or skin substitute for cutaneous wounds.

Cellesta and Cellesta Flowable Amnion

There are few published studies addressing the use of Cellesta or Cellesta Flowable Amnion. Therefore, it is not possible to conclude whether Cellesta or Cellesta Flowable Amnion has a beneficial effect on health outcomes.

Cellesta (Ventris Medical, LLC.) is a minimally manipulated amniotic membrane allograft intended as a covering or barrier to offer protection from the surrounding environment in reparative and reconstructive procedures. These procedures include but are not limited to chronic wound repair, urologic and gynecological surgeries, and burn wound reconstruction.

Cellesta Flowable Amnion (Ventris Medical, LLC.) is a chorion-free, human amniotic membrane intended for use as a regenerative wound filler for the treatment of acute, chronic and surgically-created wounds.

Cellesta Duo

There are few published studies addressing the use of Cellesta Duo. Therefore, it is not possible to conclude whether Cellesta Duo has a beneficial effect on health outcomes.

Cellesta Duo (Ventris Medical, LLC.) is a dual layer human amniotic membrane allograft. It is intended for use as a regenerative wound covering for the treatment of acute, chronic and surgically created wounds.

Cellesta Cord

There are few published studies addressing the use of Cellesta Cord. Therefore, it is not possible to conclude whether Cellesta Cord has a beneficial effect on health outcomes.

Cellesta Cord (Ventris Medical, LLC.) is an umbilical cord allograft product. Cellesta Cord is intended for use as a regenerative wound covering for the treatment of acute, chronic and surgically created wounds.

CLARIX Regenerative Cord 1K Matrix/CLARIX 100 Quick-Peel Regenerative Matrix

There are few published studies addressing the use of CLARIX. Therefore, it is not possible to conclude whether CLARIX has a beneficial effect on health outcomes.

CLARIX Regenerative Matrix (Amniox Medical, Inc.) is comprised of cryopreserved human amniotic membrane and umbilical cord. It is intended for wound healing and surgical coverings. The CLARIX Quick Peel Regenerative matrix is indicated for situations in which excess bulk may not be tolerated.

CLARIX FLO

There are few published studies addressing the use of CLARIX FLO. Therefore, it is not possible to conclude whether CLARIX FLO has a beneficial effect on health outcomes.

CLARIX FLO (Amniox Medical, Inc.) is a particulate form of CLARIX and comprised of amniotic membrane and umbilical cord products derived from human placental tissue. It is intended to facilitate replacement or supplement damaged or inadequate skin.

A Hayes report for Human Amniotic Membrane (HAM) Injections for Treatment of Chronic Plantar Fasciitis indicates that a low-quality body of evidence suggests that HAM injections may result in pain relief and improved function. None of the studies reviewed by Hayes evaluated the comparative effectiveness of amniotic tissue-derived treatments compared with other types of injections such as platelet-rich plasma or botulinum toxin, extracorporeal shockwave therapy, or surgery. Substantial uncertainty remains regarding the comparative effectiveness. The studies included for review had limited follow-up of 12 weeks or less, making it difficult to assess the long-term effects of this treatment. Double-blind RCTs with active treatment comparators (injectables, surgery, extracorporeal shockwave therapy) are needed to evaluate the effectiveness and safety of amniotic tissue–derived allograft treatments for plantar fasciitis. The products evaluated in this

report included PalinGen Sport FLOW, CLARIX FLO, and AmnioFix (Hayes, Human Amniotic Membrane Injections for Treatment of Chronic Plantar Fasciitis, 2021).

Cocoon Membrane

There are few published studies addressing the use of Cocoon Membrane. Therefore, it is not possible to conclude whether Cocoon Membrane has a beneficial effect on health outcomes.

Cocoon Membranes (Pinnacle Transplant Technologies) are human-derived amnion allografts that are a minimally manipulated placental membrane used as a wound covering and barrier. Cocoon Membranes are intended to serve as a covering and barrier for full and partial-thickness, chronic, and acute wounds.

Cogenex

~~There are no published~~ **There are few published** studies addressing the use of Cogenex amniotic membrane or Cogenex flowable amnion for wound treatment. Therefore, it is not possible to conclude whether Cogenex amniotic membrane or Cogenex flowable amnion have a beneficial effect on health outcomes.

Cogenex amniotic membrane (Ventris Medical, LLC) is a minimally manipulated amniotic membrane allograft and intended for use as a covering or barrier in wound repair or complex burn reconstruction.

Cogenex flowable amnion (Ventris Medical, LLC) is an amniotic membrane suspended in a saline solution, intended for treatment of deep or complex wound repair.

Coll-e-Derm

There are few published studies addressing the use of Coll-e-Derm. Therefore, it is not possible to conclude whether Coll-e-Derm has a beneficial effect on health outcomes.

Coll-e-Derm (Parametrics Medical) is a dermal allograft derived from human dermal tissue. It is intended to support wound and burn healing for wounds that have not healed with conventional care.

Complete AA, Complete ACA, Complete SL, and Complete FT

There are few published studies addressing the use of Complete AA, Complete ACA, Complete SL, and/or Complete FT. Therefore, it is not possible to conclude Complete AA, Complete ACA, Complete SL, and/or Complete FT have a beneficial effect on health outcomes.

Samaritan Biologics, LLC is the manufacturer of Complete SL and Complete FT. Complete SL is a single layer amnion derived allograft and Complete FT is a full thickness amnion-chorion derived allograft. They both provide a barrier to acute and chronic wounds.

Complete AA from Samaritan Biologics LLC, is a dual layer amnion derived allograft to serve as a barrier and provide protective coverage from the surrounding environment to acute and chronic wounds. Complete™ AA is a sterile, single use, dehydrated allograft derived from donated human amnion membrane.

Complete ACA, from Samaritan Biologics LLC is a three-layer amnion-chorion-amnion derived allograft to serve as a barrier and provide protective coverage from the surrounding environment to acute and chronic wounds. Complete™ ACA is a sterile, single use, dehydrated allograft derived from donated human amnion chorion membrane.

Conexa

There are few published studies addressing the use of Conexa. Therefore, it is not possible to conclude Conexa has a beneficial effect on health outcomes.

Conexa (Tornier, Inc.) is a porcine dermis tissue substitute that is intended for the reinforcement of soft tissue repaired by sutures or suture anchors during tendon repair surgery and reinforcement for rotator cuff, patellar, Achilles, biceps,

quadriceps, or other tendons. Other indications include the repair of body wall defects which require the use of reinforcing or bridging material to obtain the desired surgical outcome.

Corecyte

There are few published studies addressing the use of Corecyte for any other indications. Therefore, it is not possible to conclude whether Corecyte has a beneficial effect on health outcomes.

Corecyte (Predictive Biotech) is a minimally manipulated human tissue allograft derived from the Wharton's jelly of the umbilical cord. It is intended for use as an effective and pain free alternative to lipoaspirate and bone marrow aspirate procedures for cartilage repair.

Coretext or Protext

There are few published studies addressing the use of Coretext or Protext for wound treatment. Therefore, it is not possible to conclude whether Coretext or Protext has a beneficial effect on health outcomes.

Coretext is an amniotic membrane derived, human tissue allograft suspension product. It acts as an anti-inflammatory and is intended to provide a barrier to aid in healing of a defect. Protext is used as replacement tissue that is inserted or injected into the joint and other injured areas.

CorMatrix

There is insufficient evidence to support the use of CorMatrix due to study limitations. Larger studies are needed to establish safety, efficacy and long-term outcomes.

CorMatrix porcine SIS-ECM (CorMatrix Cardiovascular, Inc.) is a non-cross-linked extracellular matrix made from porcine small intestinal submucosa (SIS), which supposedly contains structural proteins (such as collagens) and adhesion molecules to promote tissue ingrowth and regeneration. CorMatrix is also available in envelope form (CorMatrix Cangaroo®) to hold and restrict migration of implantable electronic devices and impede infection. CorMatrix has been used in a wide variety of cardiac applications including congenital cardiac and vascular surgery, pericardial reconstruction, valve reconstruction, and acquired vascular defects at different sites.

Al Haddad et al. (2018) conducted a retrospective review of clinical outcomes following complete atrioventricular canal (CAVC) repair. A total of 73 ~~patients~~**individuals** were analyzed, with an average operative age of 22 weeks. The majority (71%) of the ~~patients~~ **individuals** underwent a 2-patch repair. A CorMatrix patch was used for ventricular septal defect (VSD) closure in 77% of the ~~patients~~ **individuals**, and/or in 75% of atrial septal defect closures. There was one in-hospital mortality (1.4%) due to respiratory failure. One **individual** ~~patient~~ required a pacemaker. At mid-term follow-up (1.6 years), a total of 7 ~~patients~~ **individuals** required 8 reoperations due to cardiac-related indications, including 5 for left atrioventricular valve (LAVV) repair, 1 for LAVV replacement, and 2 isolated residual VSDs. The authors concluded that a standardized repair for CAVC resulted in excellent outcomes with low rates of reoperations. According to the authors, CorMatrix for the closure of CAVC produced good results with equivalent outcomes to other patch materials. This study is limited by the retrospective nature of the data collection.

Kelley et al. (2017) reported on the treatment of Carpentier type IIIa and type IIIb mitral regurgitation (MR) with a large patch anterior mitral valve leaflet augmentation technique using CorMatrix extracellular matrix (ECM). A single-site chart review was conducted on ~~patients~~ **individuals** who underwent anterior leaflet augmentation performed with the Da Vinci surgical robot or through a median sternotomy. Only ~~patients~~ **individuals** who had anterior leaflet augmentation with porcine intestine ECM or autologous pericardium were included. Follow-up echocardiography was performed on all ~~patients~~ **individuals**. Histologic specimens were available on ECM patches from a subset of ~~patients~~ **individuals** who required reoperation. A total of 44 ~~patients~~ **individuals** (mean age, 62.6 ±12.2 years) underwent anterior leaflet augmentation with either porcine intestinal ECM or autologous pericardium. Eight (32%) of the ~~patients~~ **individuals** with ECM had recurrence of severe mitral regurgitation (MR) on echocardiography at an average time of 201 ±98 days. Seven (28%) ~~patients~~ **individuals** required reoperation because of failure of the ECM patch including perforation (4%), excessive patch dilation (20%), and suture line dehiscence (4%). In contrast, none of the ~~patients~~ **individuals** with pericardial augmentation developed severe MR or required operation. The authors concluded that for type III MR, a large

anterior leaflet patch technique with porcine ECM was associated with a 32% recurrence rate of severe MR related directly to patch failure. According to the authors, further research and development should be performed on the use of ECM materials with a goal to decrease the failure rate experienced in this study.

Mosala Nezhad et al. (2016) attempted to systematically review the preclinical and clinical literature on the use of CorMatrix in cardiovascular surgery. The authors found that the published clinical and preclinical studies lacked systematic reporting of functional and pathological findings in sufficient numbers of subjects. The authors identified only one level II study and only four studies that could reasonably be classified as level III studies, the remainder representing level IV studies that were case reports or small case series. The majority of published studies only reported immediate or very early postoperative findings although a handful of case reports examined outcomes past a year or more. According to the authors, there are emerging reports to suggest that, contrary to expectations, an undesirable inflammatory response may occur in CorMatrix implants in humans and longer-term outcomes at particular sites, such as the heart valves, may be suboptimal. According to the authors, large-scale clinical studies are needed driven by robust protocols that aim to quantify the pathological process of tissue repair.

Corplex

There are few published studies addressing the use of Corplex for wound treatment. Therefore, it is not possible to conclude whether Corplex has a beneficial effect on health outcomes.

Corplex (StimLabs, LLC) is a sheet of dehydrated human umbilical cord tissue used as a wound covering or barrier membrane for acute and chronic wounds.

Corplex P

There are few published studies addressing the use of Corplex P for wound treatment. Therefore, it is not possible to conclude whether Corplex P has a beneficial effect on health outcomes.

Corplex P (StimLabs, LLC) is a sterile, jelly allograft dehydrated into small pieces, packaged in sterile glass vials to supplement connective tissue voids in open wound environments. Corplex P is to be packed into the wound environment and not intended to be used as a wound covering or barrier membrane.

Cryo-Cord

There are few published studies addressing the use of Cryo-Cord for wound treatment. Therefore, it is not possible to conclude whether Cryo-Cord has a beneficial effect on health outcomes.

Cryo-Cord (Royal Biologics) is a cryopreserved semi-transparent, collagenous membrane allograft. It is intended for use as a soft tissue barrier or wound covering on chronic non-healing wounds.

Cygnus, Cygnus Dual, and Cygnus Matrix

There are few published studies addressing the use of Cygnus, Cygnus Dual, and Cygnus Matrix. Therefore, it is not possible to conclude whether Cygnus, Cygnus Dual, and Cygnus Matrix have a beneficial effect on health outcomes.

Cygnus products (VIVEX Biomedical, Inc.) are available in multiple thicknesses and are dried human amnion membrane allografts composed of a single layer of epithelial cells, a basement membrane, and an avascular connective tissue matrix. It is intended to treat acute and chronic wounds and burns and has indications for foot and ankle, ophthalmology and oral surgery use. Cygnus Dual is a semi-transparent, collagenous membrane allograft obtained with consent from healthy mothers during cesarean section delivery.

Cymetra

There are few published studies addressing the use of Cymetra. Therefore, it is not possible to conclude whether Cymetra has a beneficial effect on health outcomes.

Cymetra (LifeCell™) is a micronized, particulate form of AlloDerm™ which is an acellular dermal matrix. It is intended for soft tissue grafting and injection laryngoplasty.

Tan and Woo (2010) conducted a retrospective review from a single surgeon of 381 injections of micronized dermis (MD) in 344 ~~patients~~ **individuals** from 2000-2010, to determine whether the material is temporary or permanent. The indications for MD were for both temporary and permanent correction of glottic insufficiency. Twenty-nine percent of all injections resulted in unwanted absorption. Over-injection was needed and transcervical approach was preferred to prevent implant extrusion with over-injection (the median volume of injected material increased from 0.8 cc to 1.0 cc over the decade). In 159 ~~patients~~ **individuals** with long-term follow-up (> 1 year), there was a 14% incidence of reinjection. The operative and postoperative complication rate was 1.05%. Despite this, the overall need for open procedures in ~~patients~~ **individuals** with long-term follow-up was 20%. The authors concluded that despite the problems of inconsistency in preparation, slow absorption and need for over-injection, micronized dermis is a safe allograft material that has long-term (> 1 year) stability. The material may reduce the need for open surgery, and can be used for both temporary and permanent vocal fold augmentation. Further investigation is needed before clinical usefulness of this procedure is proven, and research with ~~randomized controlled trials~~ **RCTs** is needed to validate these findings.

Cytal

There are few published studies addressing the use of Cytal. Therefore, it is not possible to conclude whether Cytal has a beneficial effect on health outcomes.

Cytal wound matrix products (ACell, Inc.) are composed of a porcine-derived extracellular matrix, also known as urinary bladder matrix. Cytal is intended for the management of acute and chronic wounds and second-degree burns and injuries.

An ECRI report for Cytal Wound Matrix stated that the evidence is mixed as to whether Cytal Wound Matrix is more effective or better tolerated than other skin substitutes for treating wounds. Evidence gaps remain on how well Cytal performs compared to other skin substitutes (ECRI, 2019).

An ECRI report for Cytal Burn Matrix stated that there is limited evidence regarding the effectiveness of Cytal for treating burns (ECRI, 2018).

DermaBind CH, DermaBind DL, DermaBind FM, and DermaBind SL

There are few published studies addressing the use of DermaBind CH, DermaBind DL, DermaBind FM, and/or DermaBind SL for wound treatment. Therefore, it is not possible to conclude whether DermaBind CH, DermaBind DL, DermaBind FM, or DermaBind SL have a beneficial effect on health outcomes.

DermaBind CH (HealthTech Wound Care) is a dehydrated human chorion-derived membrane allograft comprised of an extracellular matrix (ECM) that is rich in collagen, fibrin, and elastin fibers native to the tissue. It is designed for application directly to acute and chronic wounds, is flexible, and is a conforming cover that adheres to complex anatomies.

DermaBind DL (HealthTech Wound Care) is designed for application directly to acute and chronic wounds, is flexible, and is a conforming cover that adheres to complex anatomies. DermaBind DL™ membrane is intended for use as a wound covering, providing protection for the wound from the external environment and maintaining a moist environment.

DermaBind FM (HealthTech Wound Care) is a dehydrated human placental membrane allograft comprised of an extracellular matrix that is rich in collagen, fibrin, and elastin fibers native to the tissue intended for use as a wound covering.

DermaBind SL™ (HealthTech Wound Care) is an amnion derived allograft for management of wounds and burn injuries.

DermACELL, DermACELL AWM, and DermACELL AWM Porous

There is insufficient evidence to support the use of DermACELL, DermACELL AWM and DermACELL AWM Porous due to study limitations. Larger studies are needed to establish safety, efficacy and long-term outcomes.

DermACELL, DermACELL AWM, and DermACELL AWM Porous (LifeNet Health®) are decellularized human dermal allografts that that are intended for the management of chronic non-healing wounds such as diabetic and venous stasis ulcers, acute burns and other associated soft tissue injuries.

Refer to the above section titled Systematic Reviews, Meta-Analyses, Guidelines and Technology Assessments That Address Multiple Skin Substitutes for additional articles/reports that evaluate DermACELL.

In a multicenter, randomized, controlled, open-label trial, Cazzell (2019a; reviewed in ECRI report above) evaluated the safety and efficacy of decellularized human acellular dermal matrices (D-ADM; DermACELL AWM) compared with conventional wound care management in ~~patients~~ **individuals** with chronic venous leg ulcers (VLUs) of the lower extremity. ~~Patients~~ **Individuals** were randomly assigned to receive either D-ADM or standard of care (control) in a 2:1 ratio. Treatment began at week 0 and wounds were evaluated on a weekly basis until wound closure was observed or the patient completed 24 weekly follow-up visits. Eighteen ~~patients~~ **individuals** were included in the D-ADM arm and 10 ~~patients~~ **individuals** in the control arm. There was a strong trend of reduction in percent wound area for D-ADM ~~patients~~ **individuals** with an average reduction of 59.6% at 24 weeks versus 8.1% at 24 weeks for control ~~patients~~ **individuals**. In addition, healed ulcers in the D-ADM arm remained closed at a substantially higher rate after termination than healed ulcers in the control. The authors concluded that D-ADM demonstrated increased healing rates and reduction in wound size compared to conventional care. The small patient population and unbalanced proportion between the 2 groups (2:1) was a limitation of this study. According to the authors, larger prospective, randomized controlled studies are needed to better assess the use of DermACELL AWM in clinical practice.

Dermacyte or Dermacyte AC Matrix Amniotic Membrane Allograft

There are few published studies addressing the use of **Dermacyte AC Matrix Amniotic Membrane Allograft or** Dermacyte Amniotic Wound Care Matrix for wound treatment. Therefore, it is not possible to conclude whether **Dermacyte AC Matrix Amniotic Membrane Allograft or** ~~the~~ Dermacyte Amniotic Wound Care Matrix has a beneficial effect on health outcomes.

Dermacyte AC Matrix Amniotic Membrane Allograft Matrix (Merakris Therapeutics, Inc.) is a sterile, lyophilized, gamma irradiated, full thickness allograft which includes amnion and chorion intended for use as a protective covering or barrier.

Dermacyte Amniotic Wound Care Matrix (Merakris Therapeutics, Inc.) is a cross-linked human amniotic membrane allograft. It is intended to provide a protective covering and support for cell growth during the healing process of diabetic ulcers, venous ulcers, pressure ulcers, and burn wounds with exposed vital structures.

Derma-Gide

There are few published studies addressing the use of Derma-Gide. Therefore, it is not possible to conclude whether Derma-Gide has a beneficial effect on health outcomes.

Derma-Gide is a collagen wound dressing for covering and regenerating soft tissue defect or soft tissue wounds.

DermaPure

There are few published studies addressing the use of DermaPure. Therefore, it is not possible to conclude whether DermaPure has a beneficial effect on health outcomes.

DermaPure (Tissue Regenex Group, PLC) is a decellularized human dermis product for the treatment of acute and chronic wounds by providing an environment that supports cell migration to facilitate the body's repair, or replacement, of damaged or inadequate skin tissue.

In a 2017 analysis, Kimmel and Gittleman evaluated the use of DermaPure, a decellularized human skin allograft, in the treatment of a variety of challenging wounds. This retrospective observational analysis reviewed a total of 37 ~~patients~~individuals from 29 different wound clinics. Each patient received one application of DermaPure which was followed until complete closure. A statistical analysis was performed with the end point being complete healing. All

wounds on average had a duration of 56 weeks and healed in an average time of 10 weeks. Individual wound categories included venous leg ulcers, which healed in 11 weeks; and surgical/traumatic wounds, which healed in 11 weeks. This study was limited by a small sample size and lack of a control group.

DermaSpan

There are few published studies addressing the use of DermaSpan. Therefore, it is not possible to conclude whether this product has a beneficial effect on health outcomes.

DermaSpan (Zimmer Biomet® Sports Medicine) is an acellular dermal matrix derived from human allograft tissue. It is intended for use in various practices, including orthopedics, plastic surgery, and general surgery, for repair and replacement of damaged or inadequate skin tissue (wound coverage).

Dermavest and Plurivest

There are few published studies addressing the use of Dermavest or Plurivest. Therefore, it is not possible to conclude whether Dermavest or Plurivest has a beneficial effect on health outcomes.

Dermavest and Plurivest (AediCell) are human amnion/chorion, umbilical cord and placental disk tissue matrixes intended to replace or supplement damaged or inadequate skin tissue and re-stabilize a debrided wound.

Derm-Maxx

There are few published studies addressing the use of Derm-Maxx for wound treatment. Therefore, it is not possible to conclude whether Derm-Maxx has a beneficial effect on health outcomes.

Derm-Maxx (Royal Biologics) is a freeze-dried decellularized dermal matrix allograft. It is intended for integumentary augmentation and serve as a covering for wounds and skin defects.

Dual Layer Impax™ Membrane

There are few published studies addressing the use of Dual Layer Impax™ Membrane. Therefore, it is not possible to conclude whether Dual Layer Impax™ Membrane has a beneficial effect on health outcomes.

Dual Layer Impax™ Membrane (Legacy Medical Consultants) is a sterile dehydrated dual layered human amniotic membrane allograft intended to serve as a barrier or cover for acute and chronic wounds and for use as a barrier to protect wounds from the surrounding environment.

DuoAmnion

Studies are lacking regarding the use of DuoAmnion for wound treatment. Therefore, it is not possible to conclude whether DuoAmnion has a beneficial effect on health outcomes.

DuoAmnion (Samaritan Biologics LLC) is a dehydrated allograft derived from donated human amniotic membrane that serves as a barrier and provides protective coverage from the surrounding environment to acute and chronic wounds.

E-Graft

Studies are lacking regarding the use of E-Graft for wound treatment. Therefore, it is not possible to conclude whether E-Graft has a beneficial effect on health outcomes.

E-Graft (Skye Biologics) is a thick layer amnion-only rolled membrane allograft intended for use as a barrier, wrap or cover for acute and chronic wounds.

Emerge Matrix

Studies are lacking regarding the use of Emerge Matrix for wound treatment. Therefore, it is not possible to conclude whether Emerge Matrix has a beneficial effect on health outcomes.

Emerge Matrix (Sequence LifeScience, Inc.) is a dual membrane, minimally manipulated, human amniotic and chorionic membrane product derived from placental tissue that retain the structural and functional characteristics of the tissue. Emerge™ Matrix consist primarily of extracellular matrix proteins and serves as a natural, biologic barrier or wound cover. The typical patient population includes those with full thickness acute and chronic wounds where a biologic barrier or wound cover is required.

Enverse

~~There are no published~~ **There are few published** studies addressing the use of Enverse for wound treatment. Therefore, it is not possible to conclude whether Enverse has a beneficial effect on health outcomes.

Enverse™ **(StimLabs LLC)** ~~-~~is comprised of dehydrated human amniotic membrane obtained from donated placental tissue. Enverse™ contains non-viable cells and is to be used as a wound covering or barrier membrane, over chronic and acute wounds, including dermal ulcers or defects.

EpiCord

There are several published studies addressing the use of EpiCord, all with study limitations. Therefore, it is not possible to conclude whether EpiCord has a beneficial effect on health outcomes.

EpiCord (MiMedx Group, Inc.) is a minimally manipulated, dehydrated, non-viable cellular umbilical cord allograft. EpiCord is intended to be used in the treatment and management of chronic and acute wounds and burns to replace or supplement damaged or inadequate skin tissue.

Refer to the above section titled Systematic Reviews, Meta-Analyses, Guidelines and Technology Assessments That Address Multiple Skin Substitutes for additional articles/reports that evaluate EpiCord.

EPIEFFECT

There are few published studies addressing the use of EPIEFFECT. Therefore, it is not possible to conclude whether EPIEFFECT has a beneficial effect on health outcomes.

EPIEFFECT (MiMedx Group, Inc.) is a lyophilized human placental-based allograft membrane that includes the amnion layer, intermediate layer, and chorion layer. EPIEFFECT is intended for use as a barrier to provide a protective environment in acute and chronic wounds.

EpiFix Injectable

There are few published studies addressing the use of EpiFix Injectable. Therefore, it is not possible to conclude whether EpiFix Injectable has a beneficial effect on health outcomes.
EpiFix Injectable (MiMedx Group, Inc.) is a micronized powder form of EpiFix amniotic membrane.

EpiFix Amnion/Chorion Membrane (Non-Injectable)

EpiFix (MiMedx Group, Inc.) is a dehydrated amnion/chorion membrane extracellular collagen allograft comprised of an epithelial layer and two fibrous connective tissue layers that is proposed for acute and chronic wound care.

Refer to the above section titled Systematic Reviews, Meta-Analyses, Guidelines, and Technology Assessments That Address Multiple Skin Substitutes for additional articles/reports that evaluate EpiFix.

The National Institute for Health and Care Excellence (NICE) MedTech innovation briefing on EpiFix indicates that 5 reviewed studies suggest that EpiFix may be an effective addition to standard care and compression therapy in people with chronic wounds. According to NICE, the key uncertainties are that there are no comparisons of EpiFix with standard National Health Service (NHS) care for any indication. Two of the 5 studies included in the report were written by the same group of authors and 4 studies were funded by the manufacturer of EpiFix (NICE 2018).

Venous Leg Ulcers

There is limited evidence related to the safety and long-term outcomes of EpiFix for treating venous leg ulcers.

An ECRI report for EpiFix for treating chronic wounds including venous leg ulcers (VLUs) reported evidence from two small ~~randomized controlled trials~~**RCTs** ~~(RCTs)~~ regarding VLUs. One RCT reported weekly EpiFix plus compression treatment healed more wounds than moist wound dressing plus compression in 12 weeks (60% versus 35%; p = 0.0128). The other RCT reported that 62% of wounds treated with EpiFix plus compression therapy achieved > 40% closure at 4 weeks compared with 32% wounds treated with compression therapy alone (p = 0.005). All studies were funded by the manufacturer. Although evidence is somewhat favorable, further studies are needed to address the evidence limitations [ECRI Institute. EpiFix Amnion/Chorion Membrane Allograft (MiMedx) for Treating Chronic Wounds. December 2019].

The earlier study reported by Bianchi et al. (2018) (refer below) only reported per-protocol (PP) study results (n = 109, 52 EpiFix and 57 standard care ~~patients~~**individuals**), although there were 128 ~~patients~~**individuals** randomized: 64 to the EpiFix group and 64 to the standard care group. The purpose of the present study (Bianchi et al., 2019; reviewed in ECRI report above) is to report intention-to-treat (ITT) results on all 128 randomized subjects and assess if both ITT and PP data analyses arrive at the same conclusion of the efficacy of EpiFix as a treatment for venous leg ulcers (VLUs). Rates of healing for the ITT and PP populations were, respectively, 50% and 60% for those receiving EpiFix and 31% and 35% for those in the standard care cohort. Within both ITT and PP analyses, these differences were statistically significant. The authors concluded that the results of this study show that, in both ITT and PP analyses, VLUs treated with EpiFix as an adjunct to debridement, moist wound dressings, and compression had significantly higher rates of healing than those treated with comprehensive wound care alone. This study was funded by the manufacturer, MiMedx Group, Inc.

Bianchi et al. (2018; reviewed in ECRI report above) conducted a randomized, controlled, multicenter clinical trial to evaluate the efficacy of EpiFix, a dehydrated human amnion/chorion membrane allograft as an adjunct to multilayer compression therapy for the treatment of non-healing full-thickness venous leg ulcers. A total of 109 subjects were randomly assigned to receive EpiFix and multilayer compression (n = 52) or dressings and multilayer compression therapy alone (n = 57). ~~Patients~~**Individuals** were recruited from 15 centers around the USA and were followed up for 16 weeks. The primary end point of the study was defined as time to complete ulcer healing. Participants receiving weekly application of EpiFix, and compression were significantly more likely to experience complete wound healing than those receiving standard wound care and compression (60% versus 35% at 12 weeks and 71% versus 44% at 16 weeks). A Kaplan-Meier analysis was performed to compare the time-to-healing performance with or without EpiFix, showing a significantly improved time to healing using the allograft. Cox regression analysis showed that subjects treated with EpiFix had a significantly higher probability of complete healing within 12 weeks versus without EpiFix. According to the authors, these results confirm the advantage of EpiFix allograft as an adjunct to multilayer compression therapy for the treatment of non-healing, full-thickness venous leg ulcers. These findings require confirmation in larger ~~randomized controlled trials~~**RCTs.** This study was sponsored and funded by the manufacturer of EpiFix, MiMedx Group, Inc.

Miranda et al. (2016) conducted a retrospective analysis of prospectively acquired data for 8 lower extremity free flaps with ulcerations in the context of venous insufficiency and/or lymphedema. The first 4 were flaps that had been treated with conservative wound care to healing. The second group was treated conservatively initially but then converted to treatment with dehydrated human amnion/chorion membrane (EpiFix) grafts. The primary endpoint was time to healing. Comparison of Kaplan-Meier survival curves revealed a significant difference between the conservatively and dehydrated human amnion/chorion membrane-treated flap ulcers, favoring graft treatment. In those ulcers that healed, the average time to healing was 87 days for the conservative treatment group and 33 days for the dehydrated human amnion/chorion membrane treatment group (with an average of 1.7 grafts per ulcer). The authors concluded that dehydrated human amnion/chorion membrane may accelerate healing of ulcers on lower extremity free flaps in **individuals** ~~patient~~ with lymphedema and/or venous disease in the treated leg. The authors stated that is study was limited by a small sample size which limits sweeping conclusions. There is also no true randomized control or comparison group available, so it cannot be firmly concluded that dHACM accelerates healing of ulcers on free flaps with lymphedematous or venous-insufficient limbs.

Serena et al. (2015) evaluated correct correlation between an intermediate rate of wound reduction (40% wound area reduction after 4-weeks treatment) and complete healing at 24 weeks in ~~patients~~ **individuals** with a venous leg ulcer (VLU) in a retrospective follow-up of the study by Serena et al. (2014) described above. Outcomes assessed were rates of

complete healing within 24 weeks of enrollment and days to healing. Data were divided into two groups based on status at RCT completion (healed at least 40% yes or no). Correct correlation with status at 4 weeks and complete healing within 24 weeks was determined. Clinical characteristics were also compared for ~~patients~~ **individuals** with and without correct correlation between 4-week and 24-week status. Fifty-five ~~patients~~ **individuals** at 5 study sites were included. Some 47 without complete healing during the initial study were eligible. As three ~~patients~~ **individuals** were lost to follow-up, a total of 44 records were evaluated. Of these, 20 (45.4%) had reduced wound size of ≥ 40% and 24 (55%) had < 40% reduction during the initial study. Complete healing occurred in 16/20 (80%) of the ≥ 40% group at a mean of 46 days and 8/24 (33.3%) of the < 40% group at a mean of 103.6 days. Overall, correct correlation of status at 4 weeks and ultimate healing status of VLU occurred in 32/44 ~~patients~~ **individuals** (73%). The authors indicated that these results confirm that the intermediate outcome used in our initial study is a viable predictor of ultimate VLU healing. According to the authors there are limitations of the present study. During the follow-up period after completion of the initial 4-week RCT, ~~patients~~ **individuals** received various treatments that may or may not have included initiation of, or additional application of dHACM, or other advanced treatments. Also, in the initial RCT, dHACM was only applied once or twice during the study period, which may not be reflective of how the treatment is used in a real world setting.

Serena et al. (2014; reviewed in ECRI report above) conducted a multicenter, randomized, controlled study to evaluate the safety and efficacy of one or two applications of dehydrated human amnion/chorion membrane allograft and multilayer compression therapy vs. multilayer compression therapy alone in the treatment of venous leg ulcers (VLU). **Individual** ~~Patient~~ inclusion criteria included presence of a VLU extending through the full thickness of the skin but not down to muscle, tendon, or bone, VLU present for at least 1 month, and VLU has been treated with compression therapy for at least 14 days. The primary study outcome was the proportion of ~~patients~~ **individuals** achieving 40% wound closure at 4 weeks. Of the 84 participants enrolled, 53 were randomized to receive allograft and 31 were randomized to the control group of multilayer compression therapy alone. At 4 weeks, 62% in the allograft group and 32% in the control group showed a greater than 40% wound closure, thus showing a significant difference between the allograft-treated groups and the multilayer compression therapy alone group at the 4-week surrogate endpoint. After 4 weeks, wounds treated with allograft had reduced in size a mean of 48.1% compared with 19.0% for controls. The authors concluded that venous leg ulcers treated with allograft had a significant improvement in healing at 4 weeks compared with multilayer compression therapy alone. According to the authors, lack of long-term follow-up data did not allow for the validation of duration of healed wounds.

Esano A, Esano AAA, Esano AC or Esano ACA

There are few published studies addressing the use of Esano A, Esano AAA, Esano AC or Esano ACA for wound treatment.

Therefore, it is not possible to conclude whether Esano A, Esano AAA, Esano AC or Esano ACA has a beneficial effect on health outcomes.

Esano A (Evolution Biologyx, LLC) is a dehydrated amniotic membrane sheet protective covering to aid in wound management.

Esano AAA (Evolution Biologyx, LLC) is a tri-layered, decellularized, dehydrated human amniotic membrane (DDHAM) with a preserved natural epithelial basement membrane and an intact extracellular matrix structure with is biochemical components to provide a protective cover and aid in wound care and surgical sites.

Esano AC (Evolution Biologyx, LLC) is a dual-layer, decellularized, dehydrated human amniotic membrane allograft that is intended for use as a cover or barrier for acute and chronic wounds and to provide protective coverage from the surrounding environment for acute and chronic wounds.

Esano™ ACA (Evolution Biologyx, LLC) is a dehydrated allograft consists of a dehydrated, triple-layer amnion/chorion/amnion allograft tissue matrix that will accommodate a variety of handling characteristics.

Excellagen

There are few published studies addressing the use of Excellagen for wound treatment. Therefore, it is not possible to conclude whether Excellagen has a beneficial effect on health outcomes.

Excellagen **(Generex Biotechnology Corporation)** is a pharmaceutically formulated fibrillar Type I bovine collagen gel for wound care management.

E-Z-Derm

There are limited studies related to E-Z-Derm for use on partial-thickness skin loss, donor sites, skin ulcerations and abrasions. Therefore, it is not possible to conclude whether E-Z-Derm has a beneficial effect on health outcomes.

E-Z Derm (Mölnlycke Health Care US, LLC) is a porcine-derived, biosynthetic xenograft intended for use on partial-thickness skin loss, donor sites, skin ulcerations and abrasions.

FlowerAmnioFlo

There are few published studies addressing the use of FlowerAmnioFlo for wound treatment. Therefore, it is not possible to conclude whether FlowerAmnioFlo has a beneficial effect on health outcomes.

FlowerAmnioFlo, also known as FlowerFlo (Flower Orthopedics Corporation) is a 100% acellular liquid amniotic fluid allograft that is injected on or in the wound site. It is intended for the treatment of non-healing wounds and burn injuries. According to the manufacturer, FlowerAmnioFlo delivers cytokines, proteins and growth factors to help generate soft tissue.

FlowerAmnioPatch

There are few published studies addressing the use of FlowerAmnioPatch for wound treatment. Therefore, it is not possible to conclude whether FlowerAmnioPatch has a beneficial effect on health outcomes.

FlowerAmnioPatch, also known as FlowerPatch (Flower Orthopedics Corporation) is a dehydrated (human) amniotic membrane allograft used for the treatment of non-healing wounds and burn injuries. According to the manufacturer, FlowerAmnioPatch delivers cytokines, proteins and growth factors to help generate soft tissue.

FlowerDerm

There are few published studies addressing the use of FlowerDerm. Therefore, it is not possible to conclude whether FlowerDerm has a beneficial effect on health outcomes.

FlowerDerm (Flower Orthopedics Corporation) hydrated acellular (human) dermal allograft matrix used for the treatment of non-healing wounds and burn injuries. According to the manufacturer, FlowerDerm contains extracellular matrix (ECM) that provides a scaffold for cellular ingrowth vascularization, tissue regeneration and formation of granulation tissue.

Fluid Flow and Fluid GF

There are few published studies addressing the use of Fluid Flow and Fluid GF. Therefore, it is not possible to conclude whether these products have a beneficial effect on health outcomes.

Fluid Flow and Fluid GF (BioLab Sciences, Inc) are human amniotic flowable allografts. These products are intended for treating acute and chronic wounds and soft tissue injury, degenerative tissue disorders, and inflammatory conditions such as tendonitis and fasciitis.

GammaGraft

There are limited studies related to GammaGraft for acute and chronic surface wounds. Therefore, it is not possible to conclude whether GammaGraft has a beneficial effect on health outcomes.

GammaGraft (Promethean Life Sciences, Inc.) is an irradiated human skin allograft intended for surface wounds, both chronic and traumatic.

Genesis Amniotic Membrane

There are few published studies addressing the use of Genesis Amniotic Membrane. Therefore, it is not possible to conclude whether Genesis Amniotic Membrane has a beneficial effect on health outcomes.

Genesis Amniotic Membrane (Genesis Biologics, Inc.) is a dehydrated, collagenous human tissue allograft is intended for the treatment of acute and chronic wounds, soft tissue injuries, surgical wounds, and infection prevention.

Grafix, GrafixPRIME, and GrafixPL PRIME

Grafix (Osiris Therapeutics, Inc.) is a cryopreserved placental membrane comprised of an extracellular matrix (ECM) containing collagen, growth factors, fibroblasts, mesenchymal stem cells (MSCs), and epithelial cells native to the tissue.

Refer to the about section titled Systematic Reviews, Meta-Analyses, Guidelines, and Technology Assessments That Address Multiple Skin Substitutes for additional articles/reports that evaluate Grafix.

An ECRI Clinical Evidence Assessment for Grafix Cellular Repair Matrix for Treating Chronic Wounds indicates that evidence from 2 RCTs (Ananian et al., 2018; Lavery et al., 2014) and 3 retrospective studies and 7 prospective studies suggest Grafix is safe and may be more effective than EpiFix dressing and noninferior to Dermagraft® at promoting chronic wound healing. Evidence from 12 studies of varied designs and quality indicates Grafix is safe and may aid healing of wounds that failed to heal with standard care alone. Grafix may be noninferior to Dermagraft® and more effective than EpiFix®, but the available evidence is insufficient to draw firm conclusions regarding comparative effectiveness. Additional independent RCTs would be useful to understand Grafix wound closure rate, healing time and likelihood of wound reoccurrence, plus other studies comparing Grafix with other active dressings and autologous skin grafts. [ECRI, Grafix Cellular Repair Matrix (Osiris Therapeutics, Inc.) for Treating Chronic Wounds, 2021].

In a prospective single-center open-label single-arm study, Farivar et al. (2019) enrolled ~~patients~~ **individuals** with active venous leg ulcers (VLUs) that had failed to heal after a trial of standard therapy of at least 12 weeks, which included weekly multilayer compression therapy along with local wound care. The same ~~patients~~ **individuals** subsequently received application of human viable wound matrix (hVWM) (Grafix) every 1 to 2 weeks in addition to standard therapy. Healing with hVWM therapy was then compared with standard therapy, with each patient serving as his own control. There were 30 VLUs in 21 consecutive eligible ~~patients~~ **individuals** who were enrolled in the study. All ~~patients~~ **individuals** were men with an average age of 67 years, and the average area of venous ulcers before hVWM initiation was 12.2 cm^2. Complete ulcer healing was achieved in 53% (16/30) of VLUs refractory to standard therapy after application of hVWM. There was a mean reduction in wound surface area by 79% after a mean treatment time of 10.9 weeks. Eighty percent of VLUs were reduced in size by half compared with 25% with standard therapy. The mean rate of reduction in ulcer area after hVWM applications was 1.69% per day vs 0.73% per day with standard therapy. It was concluded that cryopreserved placental tissue improves healing processes to achieve complete wound closure in a significant proportion of chronic VLUs refractory to standard therapy and that adjunctive therapy with hVWM provides superior healing rates in refractory VLUs. According to the authors, large randomized trials are needed to confirm these preliminary results.

Johnson et al. (2017) reported on the clinical outcomes in two nonrandomized, however statistically equal and homogenous patient cohorts receiving either a viable intact cryopreserved human placental membrane (vCPM) or a dehydrated human amnion/chorion membrane (dHACM), for the management of wounds at a single center. A total of 79 ~~patients~~ **individuals** with 101 wounds were analyzed: 40 ~~patients~~ **individuals** with 46 wounds received vCPM (Grafix) and 39 ~~patients~~ **individuals** with 55 wounds received dHACM (EpiFix). The proportion of wounds achieving complete wound closure was 63.0% (29/46) for vCPM and 18.2% (10/55) for dHACM for all treated wounds combined. According to the authors, the retrospective and nonrandomized nature of this single-center study present significant limitations.

Grafix Core

There are few published studies addressing the use of Grafix Core. Therefore, it is not possible to conclude whether Grafix Core has a beneficial effect on health outcomes.

Grafix Core **(Smith and Nephew)** is a cryopreserved chorion matrix with limited product information.

GRAFIX PLUS

Studies are lacking regarding the use of GRAFIX PLUS for wound treatment. Therefore, it is not possible to conclude whether GRAFIX PLUS has a beneficial effect on health outcomes.

GRAFIX PLUS (Smith and Nephew) is a lyophilized human placental chorionic membrane-based skin substitute product. GRAFIX PLUS is indicated for use in the treatment of acute and chronic wounds. The product acts as a wound cover, wrap, and barrier, including surgically created wounds.

Helicoll

There are limited studies related to Helicoll for wound treatments, second degree burns, and chronic ulcers. Therefore, it is not possible to conclude whether Helicoll has a beneficial effect on health outcomes.

Helicoll (MCT Medical Solutions LLC) is a semi occlusive, self-adhering collagen sheet used for wound treatments, second degree burns, and chronic ulcers. This biodegradable skin substitute is made from animal tissues.

In an evidence-based review, McNamara et al. (2020) discussed the principles in pediatric wound management and new treatments published in the literature to date. Databases were searched for relevant sources including Pubmed, Embase, Web of Science and DynaMed. Findings noted that amniotic membrane living skin equivalent is a cellular matrix that has been reportedly successful in treating pediatrics wounds and is currently under investigation in randomized clinical trials. The authors indicated that Helicoll, an acellular matrix, shows promise in children with recessive dystrophic epidermolysis bullosa. According to the authors, there have been promising results in many studies to date, but RCTs involving larger sample sizes are necessary, in order to determine the specific role these advanced products play in pediatric wounds and to identify their safety and efficacy.

Dhanraj (2015) conducted a prospective randomized controlled study to compare Helicoll, a type I pure collagen dressing, to OpSite dressing and to Scarlet Red dressing in the treatment of standardized split-thickness skin grafts (STSG) donor sites. Thirty ~~patients~~ **individuals**, over a 3-month period, underwent various reconstructive procedures, necessitating the use of STSGs. Following a simple randomized clinical protocol, the analysis of data included donor site pain, healing time of the donor site, initial absorption of the applied dressing and rate of infection with the three different dressings. ~~Patients~~ **Individuals** in the Helicoll group reported significantly less pain, less infection rate and required no dressing change when compared with the OpSite or the Scarlet Red groups. Healing time of the donor site in the Helicoll group was shorter than that in the Scarlet Red group; however, it was comparable to the OpSite group. The authors concluded that Helicoll, as a donor site dressing, is successful in providing pain-free mobility with a measurable healing rate. Study limitations include a small study population and only one wound type (STSG donor site) was evaluated.

hMatrix

There are few published studies addressing the use of hMatrix. Therefore, it is not possible to conclude whether hMatrix has a beneficial effect on health outcomes.

hMatrix PR ADM (Bacterin International, Inc) is an acellular dermal matrix allograft derived from donated human skin. It is indicated to provide appropriate support and reinforcement for hernia and abdominal wall repairs.

Human Health Factor 10 Amniotic Patch (HHF10-P)

~~There are no published~~ **There are few published** studies addressing the use of Human Health Factor 10 Amniotic Patch (HHF10-P***)*** for wound treatment. Therefore, it is not possible to conclude whether HHF10-P has a beneficial effect on health outcomes.

HHF10-P **(Wolver and Poole Distribution LLC)** is a single-layer amniotic allograft derived from donated and screened, full-term human birth tissue, specifically the immunoprivileged amnion layer. It is a semi-transparent, minimally manipulated, terminally sterilized membrane allograft. HHF10-P™is intended for homologous use to act as a covering or barrier to offer protection from the surrounding environment in clinical applications.

Hyalomatrix

There are several non-comparative published studies addressing the use of Hyalomatrix, all with study limitations. Therefore, it is not possible to conclude whether Hyalomatrix has a beneficial effect on health outcomes.

Hyalomatrix (Medline Industries, Inc.)is a non-woven pad comprised of a wound contact layer made of a derivative of hyaluronic acid (HA) in fibrous form with an outer layer comprised of a semipermeable silicone membrane. It is indicated for the management of a variety of wounds.

The ECRI reports for Hyalomatrix Tissue Reconstruction Matrix for treating burns and chronic wounds both indicated that the evidence for these products are inconclusive because there is limited evidence. No data are available to determine how Hyalomatrix compares to other wound dressings for healing any type of chronic wound (ECRI Hyalomatrix Tissue Reconstruction Matrix for treating burns, 2018; ECRI Hyalomatrix Tissue Reconstruction Matrix for treating chronic wounds, 2018, updated April 2021)).; Simman et al., 2018).

In a 2018 prospective, non-comparative clinical case series, Simman et al. (reviewed in ECRI report above) sought to analyze the efficacy of a hyaluronic acid-based matrix (Hyalomatrix) in the treatment of lesions where the extracellular matrix was lost. Twelve ~~patients~~ **individuals** with 12 serious surgical wounds of different etiologies participated. Many defects showed exposed muscle, tendons, and/or bone. After thorough debridement, a hyaluronic acid--based matrix, with a removable, semipermeable silicone top layer, was applied for the purpose of generating a neodermis. In a number of cases, the matrix was combined with negative pressure wound therapy. All wounds developed granulation tissue. Nine wounds were subsequently closed with a split-skin autograft. There was no graft failure. Three wounds healed by secondary intention. All wounds showed complete re-epithelialization. The authors concluded that in this case series, the use of a hyaluronic acid-based matrix provided a granulation tissue and all lesions healed completely, and shows a strong trend for Hyalomatrix to play an important role in supporting wound healing in complex, surgical wounds. Limitations include lack of a control group and small number of participants.

InnovaMatrix AC or Innovamatrix FS

There are few published studies addressing the use of InnovaMatrix AC and Innovamatrix FS. Therefore, it is not possible to conclude whether InnovaMatrix AC or Innovamatrix FS has a beneficial effect on health outcomes.

InnovaMatrix AC **(Convatec Triad Life Sciences, LLC) is** a skin substitute created from extracellular matrix (ECM) found in porcine placenta for the treatment of acute, traumatic, and chronic wound care.

InnovaMatrix FS **(Convatec Triad Life Sciences, LLC)** is a decellularized extracellular matrix (ECM) topical wound covering derived from porcine placental tissue.

Integra Flowable Wound Matrix

There are several published studies addressing the use of Integra Flowable Wound Matrix, all with study limitations. Therefore, it is not possible to conclude whether Integra Flowable Wound Matrix has a beneficial effect on health outcomes.

Integra flowable wound matrix (Integra Life Sciences, Inc.) is an advanced wound care product comprised of granulated cross-linked bovine tendon collagen and glycosaminoglycan. It is intended for the management of deep or tunneling wounds.

InteguPly

There are few published studies addressing the use of InteguPly. Therefore, it is not possible to conclude whether this product has a beneficial effect on health outcomes.

InteguPly (AZIYO® Biologics) is a human acellular dermal matrix intended for the treatment of chronic diabetic foot ulcers, venous leg ulcers and pressure wounds. It is also intended for the Support, protection, reinforcement or covering of tendon, ligament and rotator cuff.

Interfyl

There are few published studies addressing the use of Interfyl. Therefore, it is not possible to conclude whether Interfyl has a beneficial effect on health outcomes.

Interfyl (Celularity) is a decellularized and dehydrated placental disc (chorionic plate) derived extracellular matrix. Interfyl is intended for treating deep dermal wounds, irregularly-shaped and tunneling wounds, augmentation of deficient/inadequate soft tissue, and the repair of small surgical defects.

Keramatrix

There are several studies related to Keramatrix, all with study limitations. Therefore it is not possible to conclude whether Keramatrix has a beneficial effect on health outcomes.

Keramatrix (Keraplast Technologies LLC) is an absorbable keratin rich dressing indicated for full and partial thickness wounds with low to high exudate. It is comprised of freeze dried acellular, animal-derived keratin protein.

Loan et al. (2016) conducted a controlled study that included 40 ~~patients~~ **individuals** with superficial or partial thickness burn injuries treated with Keramatrix, compared to 40 historical controls who received standard of care treatment. The results indicated a significantly faster mean healing time in the Keramatrix group than in the control group (8.7 days vs. 14.4 days). This is a small, nonrandomized trial.

Davidson et al. (2013) conducted a randomized controlled trial using a standard care alginate (Algisite) dressing side by side with an experimental dressing (Keramatrix) on 26 ~~patients~~ **individuals** with partial-thickness donor site wounds. The proximal/distal placement of the control and treatment was randomized. Percentage epithelialization after approximately 7 days was estimated from which time to fully epithelialize can be inferred. ~~Patients~~ **Individuals** were grouped into "young" (≤ 50 y/o) and "old" (> 50 y/o). For the "old" ~~patients~~**individuals** (n = 15), the median epithelialization percentage at 7 days is 5% and was significantly greater for the experimental dressing. For the "young" ~~patients~~ **individuals** (n = 11), the median epithelialization percentage at 7 days was 80% and there is no significant difference between the experimental and standard care control dressings. The authors concluded that Keramatrix dressing significantly increases the rate of epithelialization of acute, traumatic partial-thickness wounds in older ~~patients~~ **individuals**. This study was limited by a small sample size and short follow-up time.

Kerasorb

There are few published studies addressing the use of Kerasorb. Therefore, it is not possible to conclude whether Kerasorb has a beneficial effect on health outcomes.

Kerasorb (Keraplast Technologies LLC) is a keratin protein based topical wound and surgical dressing for treating skin wounds.

Kerecis Omega3 Products

There are several studies related to Kerecis Omega3 Products all with study limitations. Although the evidence for this product is somewhat favorable, there is limited evidence related to the safety and long-term outcomes of these products.

Kerecis (formally known as Marigen) produces skin and tissue-based products for use in surgery and for treating wounds**, including burns**. Kerecis products include Omega3 Wound, Omega3 Burn, and Omega3 Surgical. These products are made from fish (piscine) dermis designed for treating chronic wounds.

A Hayes (2024) evolving evidence review for Kerecis Omega3 Wound (Kerecis) Fish Skin Grafts for the management of burns indicated minimal support in both clinical studies and systematic review. There were no guidelines found at the time of this review. One very poor quality retrospective comparison study suggests that deep partial-thickness burns treated with Kerecis Omega3 Wound had statistically significantly shorter 95% re-epithelialization time and better scar quality at 12 months follow-up versus deep partial-thickness burns treated with split-thickness skin graft (STSG). Pain and itchiness levels were low for both Kerecis Omega3 Wound and STSG.

A Hayes evolving evidence review for Kerecis® Omega3 Wound (Kerecis® Limited) for the management of chronic lower extremity wounds includes 3 poor quality and one fair quality study describing the clinical benefits of wound healing. One randomized controlled trial (RCT) found better healing outcomes with Kerecis® than **those with** a collagen-alginate dressing. Additional RCTs are needed to determine if Kerecis® Omega3 Wound is better, worse, or the same as opposing alternatives, such as other animal-derived grafts. Kerecis® Omega3 Wound has been suggested and tested for use in additional applications; however, the focus of this report was restricted to its use in chronic wounds of the lower leg. Based on these current studies and the large number of identified ongoing studies, this technology's evidence base should be regarded as evolving and monitored for new publications (Hayes 2022).

An ECRI report for Omega3 Wound Matrix (Kerecis®) for Treating Acute Wounds indicated that the evidence is inconclusive due to too few data on outcomes and comparisons of interest. A single center study and a single center case study was identified with major limitations and a high risk of bias (ECRI April 2020).
An ECRI report for Omega3 Wound Matrix (Kerecis) for Treating Chronic Wounds indicated that the evidence is inconclusive due to too few data on outcomes and comparisons of interest. (ECRI Updated 2023).

Gao et al. (2023) conducted a systematic review and meta-analysis evaluating the effectiveness of FSG as an adjuvant treatment of SOC for chronic ulcer treatment. Chronic wounds are wounds failing to heal through a timely and orderly standard of care (SOC) treatment. SOC treatment has been commonly applied for management of chronic wounds, but SOC alone may not be adequate to heal all ulcers effectively. Fish skin graft (FSG) is a xenogenic skin substitute made from the skin of North Atlantic cod which could be used for accelerating skin healing. Several RCTs trials have identified the efficacy of FSG with rather small sample sizes. There has not been any high-level evidence published to integrate the current available evidence about the clinical efficacy of FSG for treating chronic wounds. A total of 8 studies were included in qualitative synthesis and meta-analysis, with 145 individuals treated by SOC and 245 individuals treated by SOC plus FSG. There was no significant difference between two groups for time to healing (MD = 1.99, 95% CI: -3.70~7.67, p = 0.493). The complete healing rate was significantly higher in FSG group compared with SOC alone (OR = 3.44, 95% CI: 2.03~5.82, p < 0.001*). Mean percentage area reduction (PAR) was reported in six studies, with a range of 71.6~97.3%. However, many of these studies did not report the value of standard deviation (SD), so we could not pool the data. No significantly different ulcer recurrence rate (RR = 0.60, 95% CI: 0.07~5.27, p = 0.645) and severe adverse events (SAEs) risk (RR = 1.67, 95% CI: 0.42~6.61, p = 0.467) were found between two groups. Study limitations included: different points of follow-up, and the data that resulted from that final follow-up may cause risk of bias on the pooling results; included studies were lacking regarding the safety of FSG; studies had a small sample size; this study was designed to evaluate the efficacy of FSG in management of chronic ulcers, including DFU, PAD, VU, and other complicated chronic wounds. Conducting subgroup analyses on diverse types of wounds could possibly provide more reliable conclusions. The authors note that the application of FSG treatment for individuals with chronic ulcers that do not respond well to SOC management could significantly increase the complete healing rate compared with SOC alone, without increased recurrence rate and SAEs risk. Additional studies are needed with larger sample sizes with a focus on individual wound types to provide higher-quality evidence. (Lantis et al., Lullove et al., Luze et al. are included in this review)**

Luze et al. (2022) conducted a systematic review summarizing the current published evidence on the use of acellular fish skin (AFS) in the treatment of burn injuries. Acellular fish skin acts as a skin substitute, decreasing the inflammatory response and promoting proinflammatory cytokines that help wound healing. These properties might represent an effective treatment approach in burn wound management. A systematic review of the literature, up to March 2022, which resulted in 14 trials investigating the effects of acellular fish skin in burn wounds or split-thickness donor sites were determined eligible and included in the present review. Nile Tilapia were evaluated in seven of the trials and Kerecis Omega 3 (North Atlantic cod) was evaluated in five trials. Present evidence on the use of acellular fish skin shows an acceleration of wound healing, reduction in pain and necessary dressing changes as well as improved aesthetic and functional outcomes compared to conventional treatment options. Study limitations includes a small size of study cohorts, and the results cannot be pooled; studies are geographically limited based on availability of xenografts and comparison studies are needed between products. Acellular fish skin xenografts may be an effective treatment of superficial- and partial-thickness burns. Larger cohort studies are needed to clarify the full potential of this promising approach.

Kirsner et al. (2020), in a prospective randomized controlled trial, compared ~~fish skin grafts~~ **FSG** to human amnion/chorion membrane allografts in acute would healing. Grafts can come from the **individuals's** ~~patient's~~ own skin (autograft), a human donor (allograft), or from a different species (xenograft). A fish skin xenograft from cold-water fish (Atlantic cod, Gadus morhua) is a relatively new option that shows promising preclinical and clinical results in wound healing. Chronic wounds vary greatly in etiology and nature, requiring large cohorts for effective comparison between therapeutic alternatives. In this study, they attempted to imitate the status of a freshly debrided chronic wound by creating acute full-thickness wounds, 4 mm in diameter, on healthy volunteers to compare two materials frequently used to treat chronic wounds: fish skin and dHACM. The purpose is to give an indication of the efficacy of the two therapeutic alternatives in the treatment of chronic wounds in a simple, standardized, randomized, controlled, double-blind study. All volunteers were given two identical punch biopsy wounds, one of which was treated with a ~~fish skin graft~~**FSG** and the other with dehydrated human amnion/chorion membrane allograft (dHACM). In the study, 170 wounds were treated (85 wounds per group). The primary endpoint was defined as time to heal (full epithelialization) by blinded assessment at days 14, 18, 21, 25, and 28. The superiority hypothesis was that the ~~fish skin grafts~~**FSGs** would heal the wounds faster than the dHACM. To evaluate the superiority hypothesis, a mixed Cox proportional hazard model was used. Wounds treated with fish skin healed significantly faster [hazard ratio 2.37; 95% confidence interval: (1.75-3.22; p = 0.0014)] compared with wounds treated with dHACM. The results show that acute biopsy wounds treated with ~~fish skin grafts~~**FSGs** heal faster than wounds treated with dHACM. Limitations of this study included acute wounds from a punch biopsy rather than chronic non-healing wounds. Larger studies are needed to include participants with chronic unhealing wounds.

Keroxx

There are few published studies addressing the use of Keroxx. Therefore, it is not possible to conclude whether Keroxx has a beneficial effect on health outcomes.

Keroxx Flowable Wound Matrix (Molecular Biologicals, Inc.) is wound matrix comprised of keratin enriched proteins that is intended to aid in the growth of new tissue in wounds. These keratin proteins are extracted from sheep wool and are placed in an open celled injectable gel format.

Lamellas and Lamellas XT

Studies are lacking regarding the use of Lamellas and Lamellas XT for wound treatment. Therefore, it is not possible to conclude whether Lamellas and/or Lamellas XT has a beneficial effect on health outcomes.

Lamellas and Lamellas XT (Keyport Management) is intended for use as a protective wound covering and barrier in acute and chronic wounds.

MatriDerm

There are several studies related to MatriDerm, all with study limitations. Therefore, it is not possible to conclude whether MatriDerm has a beneficial effect on health outcomes.

MatriDerm (MedSkin Solutions, Dr. Suwelack AG, Billerbeck, Germany) is a single-use three-dimensional acellular dermal matrix composed of bovine collagen fibers and bovine elastin. MatriDerm is indicated for the management of wounds including full thickness and partial thickness wounds, chronic wounds (e.g. pressure ulcers, venous ulcers, diabetic ulcers, chronic ulcers), surgical wounds (donor sites/grafts, post-Moh's surgery, post-laser surgery, podiatric, wound dehiscence), partial thickness burns, trauma wounds (abrasions, lacerations and skin tears) and draining wounds.

In a 2023 ECRI clinical evidence assessment for treating burns, there was one RCT (Vana et al. (2020) and two nonrandomized comparison studies that suggested that MatriDerm is safe and works as intended to aid healing of burns and burn scar reconstruction in conjunction with split-thickness skin grafts; however, the studies provided very-low-quality evidence and assess too few patients to be conclusive.

In a 2023 ECRI clinical evidence assessment) for managing wounds following otorhinolaryngology surgery, evidence from four low-quality studies (three nonrandomized comparison studies and one case series) suggests Matriderm is safe and works as intended to aid in managing and repairing otorhinolaryngology defects both as a

standalone treatment and in conjunction with skin grafts and stromal vascular cells; however, the studies have a high a risk of bias and evaluate too few patients to be conclusive.

Matrion

There are few published studies addressing the use of Matrion. Therefore, it is not possible to conclude whether Matrion has a beneficial effect on health outcomes.

Matrion (LifeNet Health) is a regenerative human placental allograft procured and processed from donated human tissue. The resulting decellularized placental membrane is available in membrane, injectable, and sponge configurations for use in wound, tendon, and nerve application. Matrion is intended to modulate inflammation in the surgical sites, enhance healing, and act as a barrier.

MatriStem MicroMatrix

There are several studies related to MatriStem **MicroMatrix,** all with study limitations. Therefore it is not possible to conclude whether MatriStem **MicroMatrix** has a beneficial effect on health outcomes.

MatriStem (ACell Inc.) products consist of collagens, carbohydrates, and proteins derived from the urinary bladder tissue of pigs. MatriStem is intended for surgical wound care, pelvic floor support or reconstruction, burns, and wound healing.

Refer to the above section titled Systematic Reviews, Meta-Analyses, Guidelines and Technology Assessments That Address Multiple Skin Substitutes for additional articles/reports that evaluate MatriStem.

Matrix HD Allograft Dermis

There are few published studies addressing the use of Matrix HD Allograft Dermis. Therefore, it is not possible to conclude whether Matrix HD Allograft Dermis has a beneficial effect on health outcomes.

Matrix HD Allograft Dermis (Royal Wound-X, Inc, RTI Surgical is intended as a wound cover to help repair, replace, reconstruct, or supplement damaged soft tissue in acute and chronic wounds including diabetic foot ulcers and burns.

Mediskin

There is limited evidence related to the efficacy and long-term outcomes of Mediskin for treating wounds. Therefore, it is not possible to conclude whether Mediskin has a beneficial effect on health outcomes.

Mediskin **(Brennen Medical, Inc)** is a porcine-derived decellularized fetal skin product.

In a prospective randomized, 3-arm, clinical study, Karlsson et al. (2014) compared Aquacel, Allevyn, and Mediskin I in the treatment of split-thickness skin graft donor sites in 67 adults. ~~Patients~~ **Individuals** were randomly assigned to treatment with Aquacel, Allevyn, or Mediskin I. The donor site was assessed on postoperative days 3, 14, and 21 for healing, infection, pain, impact on everyday life, and ease of use. The obtained results demonstrate significantly faster re-epithelialization for ~~patients~~**individuals** treated with Aquacel or Mediskin I compared with Allevyn. Regarding infections, there were no significant differences between the groups. ~~Patients~~**Individuals** wearing Aquacel experienced significantly less pain changing the dressing and less impact on everyday life than the ~~patients~~**individuals** wearing Allevyn. According to the authors, Aquacel was shown to be significantly easier for the caregiver to use than Allevyn and Mediskin I. These findings require confirmation in a larger controlled trial.

Membrane Graft, Membrane Wrap or Membrane Wrap-Hydro

There are few published studies addressing the use of Membrane Graft, Membrane Wrap and Membrane Wrap-Hydro. Therefore, it is not possible to conclude whether these products have a beneficial effect on health outcomes.

Membrane Graft and Membrane Wrap (BioLab Sciences, Inc.) are human amniotic allograft membranes that are intended to be used to repair tissue deficits and to reduce healing time for chronic wounds and post-surgical wounds.

Membrane Wrap-Hydro™ (BioLab Sciences) is a hydrated human amnion membrane indicated for chronic and acute wounds. The product serves as protective covering from the surrounding environment for acute and chronic wounds.

MemoDerm

There are few published studies addressing the use of MemoDerm. Therefore, it is not possible to conclude whether this product has a beneficial effect on health outcomes.

MemoDerm (Stryker®) is an acellular dermal matrix derived from human allograft tissue. It is manufactured using a proprietary gamma irradiation sterilization process. It is marketed for use for joint surgeries and chronic diabetic foot ulcers.

Microlyte Matrix

There are few published studies addressing the use of Microlyte Matrix for wound treatment. Therefore, it is not possible to conclude whether Microlyte Matrix has a beneficial effect on health outcomes.

Microlyte® Matrix **(Imbed Biosciences)** comprises a polyelectrolyte multilayer (PEM) nanofilm of cationic and anionic polymers, which together act as a functional molecular template to facilitate the granulation in the wound bed. Microlyte Matrix provides just the right combination of a synthetic wound matrix and moisture management to facilitate healing in acute and chronic wounds.

MicroMatrix Flex

There are few published studies addressing the use of MicroMatrix Flex for wound treatment. Therefore, it is not possible to conclude whether MicroMatrix Flex has a beneficial effect on health outcomes.

MicroMatrix Flex (Acell) is a dual-syringe system designed to enable convenient mixing and delivery of MicroMatrix paste to hard-to-reach wound areas. intended for the management of wounds including: partial and full-thickness wounds, pressure ulcers, venous ulcers, diabetic ulcers, chronic vascular ulcers, tunneled/undermined wounds, surgical wounds (donor sites/grafts, post-Moh's surgery, post-laser surgery, podiatric, wound dehiscence), trauma wounds (abrasions, lacerations, partial thickness burns, skin tears) and draining wounds. The device is intended for one-time use

MIRODERM

There are few published studies addressing the use of MIRODERM for wound treatment. Therefore, it is not possible to conclude whether MIRODERM has a beneficial effect on health outcomes.

MIRODERM (Miromatrix Medical) is a non-crosslinked acellular wound matrix that is derived from porcine liver and is processed and stored in a phosphate buffered aqueous solution. It is intended for the management of wounds.

MiroTract Wound Matrix

There are few published studies addressing the use of MiroTract Wound Matrix for wound treatment. Therefore, it is not possible to conclude whether MiroTract Wound Matrix has a beneficial effect on health outcomes.

MiroTract Wound Matrix (Reprise Biomedical, Inc) is a single use, non-crosslinked acellular wound dressing that is derived from porcine liver tissue. The porcine liver is perfusion decellularized resulting in a collagen matrix that is dried, cut to size, and radially compressed onto the guidewire of the MiroTract delivery system. The delivery system includes a guidewire and tamp tube to manually push the MiroTract Wound Matrix off the guidewire into a wound. The MiroTract Wound Matrix is intended for the management of wounds including: partial and full thickness wounds, pressure ulcers, venous ulcers, chronic vascular ulcers, diabetic ulcers, tunneled, undermined wounds, trauma wounds (abrasions, lacerations, partial thickness burns, and skin tears), draining wounds, surgical wounds (donor sites/grafts, post-Mohs' surgery, post-laser surgery, podiatric, and wound dehiscence

Mirragen

There are few published studies addressing the use of Mirragen. Therefore, it is not possible to conclude whether Mirragen has a beneficial effect on health outcomes.

Mirragen Advanced Wound Matrix **(Engineered Tissue Solutions, LLC)** is a synthetic, resorbable skin substitute made of biocompatible and resorbable borate-based glass fibers and particulates. The material covers the wound, absorbs exudate, and provides a matrix or scaffold material that the body uses for revascularization and soft tissue regeneration. It is intended to be used to treat a variety of acute and chronic wounds including diabetic ulcers, pressure ulcers, vascular ulcers, trauma wounds, surgical incisions, and first- and second-degree burns.

MLG-Complete

~~There are no published~~ **There are few published** studies addressing the use of MLG-Complete for wound treatment. Therefore, it is not possible to conclude whether MLG-Complete has a beneficial effect on health outcomes.

MLG Complete™ **(Samaritan Biologics LLC)** is a full thickness amnion-chorion derived allograft for management of wounds and burn injuries. MLG Complete™ is a sterile, single use, dehydrated allograft derived from donated human amnion-chorion membrane that acts as a cover and a barrier that offers protection from the surrounding environment. The intended use of MLG Complete™ includes the management of wounds, such as, partial and full thickness wounds, pressure sores/ulcers, venous ulcers, diabetic ulcers, chronic vascular ulcers, tunneled/undermined wounds, surgical wounds (e.g. donor site/grafts, post-laser surgery, post-Mohs surgery, podiatric wounds, wound dehiscence), trauma wounds, (e.g., abrasions, lacerations, partial thickness burns, skin tears), and draining wounds.

MOST

~~There are no published~~ **There are few published** studies addressing the use of MOST for wound treatment. Therefore, it is not possible to conclude whether MOST has a beneficial effect on health outcomes.

MOST (Samaritan Biologics LLC) is a perforated three-layer amnion-chorion-amnion derived allograft to serve as a barrier and provide protective coverage from the surrounding environment to acute and chronic wounds.

MyOwn Skin

There are few published studies addressing the use of MyOwn Skin. Therefore, it is not possible to conclude whether MyOwn Skin has a beneficial effect on health outcomes.

MyOwn Skin (BioLab Sciences, Inc.) is an autologous, homologous skin product. This product is composed of an individual's own viable skin cells and is intended to support cellular attachment and proliferation for tissue and skin repair.

NeoMatriX

There are few published studies addressing the use of NeoMatriX. Therefore, it is not possible to conclude whether NeoMatriX has a beneficial effect on health outcomes.

NeoMatriX (NeXtGen Biologics) is fabricated from the dermal extracellular matrix of axolotl. This device is derived from an amphibian farm-raised hybrid axolotl source from a closed herd in a dedicated facility. NeoMatriX wound matrix provides an adherent covering that protects the wound from the environment.

NeoPatch

There are few published studies addressing the use of NeoPatch for wound treatment. Therefore, it is not possible to conclude whether this product has a beneficial effect on health outcomes.

NeoPatch (Cryolife, Inc.) is a wound covering derived from terminally sterilized, dehydrated human placental membrane tissue comprised of both amnion and chorion.

NEOX

There are few published studies addressing the use of NEOX for wound treatment. Therefore, it is not possible to conclude whether NEOX has a beneficial effect on health outcomes.

NEOX Wound Allografts (Amniox® Medical, Inc.) are comprised of two products, NEOX CORD 1K Wound Allograft which is a cryopreserved human umbilical cord and amniotic membrane; and NEOX 100 Wound Allograft which is a cryopreserved human amniotic membrane indicated for minor and superficial dermal wounds. Both are indicated as wound covering for dermal ulcers and defects.

NEOX FLO

~~There are no published~~ **There are few published** studies addressing the use of NEOX FLO for wound treatment. Therefore, it is not possible to conclude whether this product has a beneficial effect on health outcomes.

NEOX FLO (Amniox® Medical, Inc.) is a particulate form of NEOX and comprised of amniotic membrane and umbilical cord products derived from human placental tissue. It is intended to be used as a wound covering for dermal ulcers and defects. such as diabetic ulcers.

A 2021 ECRI clinical evidence assessment did not identify any published studies regarding NEOX FLO's safety and efficacy for treating chronic wounds.

NeoStim Membrane, NeoStim DL Membrane, NeoStim TL

~~There are no published~~ **There are few published** studies addressing the use of NeoStim products. Therefore, it is not possible to conclude whether these products have a beneficial effect on health outcomes.

NeoStim products include NeoStim Membrane (single layer), NeoStim DL(double layer) and NeoStim TL (triple layer) dehydrated amnion membrane allografts that are derived from donated human amniotic membrane; NeoStim products serve as a barrier or provides a protective coverage from the surrounding environment for acute and chronic wounds such as; partial and full thickness wounds, pressure ulcers, venous ulcers, diabetic ulcers, chronic vascular ulcers, tunneled/undermined wounds, surgical wounds and trauma wounds.

Novachor

There are few published studies addressing the use of Novachor. Therefore, it is not possible to conclude whether Novachor has a beneficial effect on health outcomes.

Novachor (Organogenesis, Inc.) is comprised of the chorion layer of the placental membranes. It is intended to be applied as a graft to protect the wound and support healing for acute and chronic wounds, including neuropathic ulcers, venous stasis ulcers, pressure ulcers, burns, post-traumatic wounds and post-surgical wounds.

Novafix

There are few published studies addressing the use of Novafix. Therefore, it is not possible to conclude whether Novafix has a beneficial effect on health outcomes.

Novafix (Triad Life Sciences, Inc.) is a dehydrated human amniotic membrane allograft indicated for use in the management of wounds.

Novafix DL

There are few published studies addressing the use of Novafix DL. Therefore, it is not possible to conclude whether Novafix DL has a beneficial effect on health outcomes.

Novafix DL (Triad Life Sciences, Inc.) is an amnion-chorion membrane, composed of placental extracellular matrix donated by prescreened mothers electing caesarean birth that is used to offer protection in the treatment of superficial and traumatic injuries.

NovoSorb SynPath

There are few published studies addressing the use of NovoSorb SynPath. Therefore, it is not possible to conclude whether NovoSorb SynPath has a beneficial effect on health outcomes.

NovoSorb® SynPath is a synthetic dermal matrix comprised of a porous network of nontoxic, biodegradable synthetic polymers that acts as a scaffold to support the proliferation of cells involved in cellular repair. NovoSorb BTM (Biodegradable Temporizing Matrix) may be used to temporarily close the wound and aid the body in generating new tissue.

NuDYN

There are few published studies addressing the use of NuDYN for wound treatment. Therefore, it is not possible to conclude whether NuDYN has a beneficial effect on health outcomes.

NuDYN (Fida Pharma) is an injectable, flowable amniotic membrane derived allograft packaged in sterile vials intended for topical application to the wound surface and supports wound healing and soft tissue repair. It is a non-surgical alternative for healthcare providers to offer ~~their patients~~**individuals** and compliments products such as Hyalgen. Its properties include hyaluronic acid, collagen, and growth factors which protect, lubricate and support the tissue.

NuShield

There are ~~few published~~**limited** studies addressing the use of NuShield. Therefore, it is not possible to conclude whether NuShield has a beneficial effect on health outcomes.

NuShield (NuTech) is a protective patch derived from amniotic membrane and is indicated as an adhesion barrier, wound covering, and acts as an adjunct to soft tissue healing, and is intended for use in spinal surgery and as a protective barrier for tendons and nerves following tendon repair.

Omeza Collagen Matrix

There are few published studies addressing the use of Omeza Collagen Matrix. Therefore, it is not possible to conclude whether Omeza Collagen Matrix has a beneficial effect on health outcomes.

Omeza® Collagen Matrix **(Omeza)** is a wound care matrix comprised of hydrolyzed fish collagen infused with cod liver oil, which acts as an anhydrous skin protectant. When applied to a wound surface, the matrix is naturally incorporated into the wound over time. Omeza® Collagen Matrix is designed for intimate contact with both regular and irregular wound beds, to provide a conducive environment for the patient's natural wound healing process. It is indicated for the management of wounds including: partial and full-thickness wounds, pressure ulcers, venous ulcers, diabetic ulcers, chronic vascular ulcers, tunneled/undermined wounds, surgical wounds (donor sites/grafts, post-Moh's surgery, post-laser surgery, podiatric, wound dehiscence), trauma wounds (abrasions, lacerations, superficial partial thickness burns, skin tears) and draining wounds.

ORION

There are few published studies addressing the use of ORION. Therefore, it is not possible to conclude whether ORION has a beneficial effect on health outcomes.

ORION (Legacy Medical Consultants, LLC) is a sterile dehydrated dual layered human amniotic membrane allograft. ORION Amniotic Membrane is intended to serve as a barrier or cover for acute and chronic wounds and for use as a barrier to protect wounds from the surrounding environment.

PalinGen

There are several studies related to PalinGen, all with study limitations. Therefore it is not possible to conclude whether PalinGen has a beneficial effect on health outcomes.

PalinGen Membrane (Amnio Technology, LLC) is a human allograft comprised of amniotic membrane. It is intended to repair or replace soft tissue defects, soft trauma defects, tendinitis, tendinosis, chronic wound repair and localized inflammation. PalinGen Flow and SportFlow (Amnio Technology LLC) are human allografts comprised of amnion and amniotic fluid components, providing a liquid allograft to "aid in the healing" and repair of chronic wounds. These products are marketed for use in the following orthopedic clinical conditions: chronic pain; joint pain; localized inflammation; tendon, fasciae, ligament, and capsule repair; synovial injuries, injured chondral surfaces, chronic tendinopathies, and tendinosis.

A Hayes report for Human Amniotic Membrane (HAM) Injections for Treatment of Chronic Plantar Fasciitis indicates that a low-quality body of evidence suggests that HAM injections may result in pain relief and improved function. None of the studies reviewed by Hayes evaluated the comparative effectiveness of amniotic tissue-derived treatments compared with other types of injections such as platelet-rich plasma or botulinum toxin, extracorporeal shockwave therapy, or surgery. Substantial uncertainty remains regarding the comparative effectiveness. The studies included for review had limited follow-up of 12 weeks or less, making it difficult to assess the long-term effects of this treatment. Double-blind RCTs with active treatment comparators (injectables, surgery, extracorporeal shockwave therapy) are needed to evaluate the effectiveness and safety of amniotic tissue-derived allograft treatments for plantar fasciitis. The products evaluated in this report included PalinGen Sport FLOW, Clarix FLO, and AmnioFix (Hayes, Human Amniotic Membrane Injections for Treatment of Chronic Plantar Fasciitis, 2021).

Hanselman et al. (2015) compared a novel treatment, cryopreserved human amniotic membrane (c-hAM), to a traditional treatment, corticosteroid. The hypothesis was that c-hAM would be safe and comparable to corticosteroids for plantar fasciitis (PF) in regard to **individual** ~~patient~~ outcomes. A randomized, controlled, double-blind, single-center pilot study was completed. ~~Patients~~ **Individuals** were randomized into one of 2 treatment groups: c-hAM or corticosteroid. ~~Patients~~ **Individuals** received an injection at their initial baseline visit with an option for a second injection at their first 6-week follow-up. Total follow-up was obtained for 12 weeks after the most recent injection. The primary outcome measurement was the Foot Health Status Questionnaire (FHSQ). The secondary outcome measurements were the Visual Analog Scale (VAS) and verbally reported percentage improvement. Data were analyzed between groups for the 2 different cohorts (1 injection versus 2 injections). Twenty-three ~~patients~~ **individuals** had complete follow-up. Fourteen were randomized to receive corticosteroid and 9 were randomized to receive c-hAM. Three ~~patients~~ **individuals** in each group received second injections. With the numbers available, the majority of outcome measurements showed no statistical difference between groups. The corticosteroid did, however, have greater FHSQ shoe fit improvement at 6 weeks, FHSQ general health improvement at 6 weeks, and verbally reported improvement at 12 weeks in the one-injection cohort. Cryopreserved hAM had greater FHSQ foot pain improvement at 18 weeks in the 2-injection cohort. The authors concluded that cryopreserved hAM injection may be safe and comparable to corticosteroid injection for treatment of plantar fasciitis. According to the authors, this is a pilot study and requires further investigation. This study was not sufficiently powered to detect between-group differences; therefore, no definitive conclusions can be made regarding the comparative effectiveness of c-hAM and corticosteroid treatment for ~~patients~~ **individuals** with chronic PF. Study limitations include small sample size, no comparison of baseline characteristics, limited follow-up, and lack of power analysis.

Zelen et al. (2013) reported the results of a randomized clinical trial examining the efficacy of micronized dehydrated human amniotic/chorionic membrane (mDHACM) injection as a treatment for chronic refractory plantar fasciitis. An institutional review board-approved, prospective, randomized, single-center clinical trial was performed. Forty-five ~~patients~~individuals were randomized to receive an injection of 2 cc 0.5% Marcaine plain, then either 1.25 cc saline (controls), 0.5 cc mDHACM, or 1.25 cc mDHACM. Follow-up visits occurred over 8 weeks to measure function, pain, and functional health and well-being. Significant improvement in plantar fasciitis symptoms was observed in ~~patients~~**individuals** receiving 0.5 cc or 1.25 cc mDHACM versus controls within 1 week of treatment and throughout the study period. At 1-week, American Orthopedic Foot and Ankle Society (AOFAS) Hindfoot scores increased by a mean of 2.2 ±17.4 points for controls versus 38.7 ±11.4 points for those receiving 0.5 cc mDHACM and 33.7 ±14.0 points for those receiving 1.25 cc mDHACM. By week 8 AOFAS Hindfoot scores increased by a mean of 12.9 ±16.9 points for controls versus 51.6 ±10.1 and 53.3 ±9.4 for those receiving 0.5 cc and 1.25 cc mDHACM, respectively. No significant difference in treatment response was observed in ~~patients~~**individuals** receiving 0.5 cc versus 1.25 cc mDHACM. The authors concluded that in ~~patients~~**individuals** with refractory plantar fasciitis, mDHACM is a viable treatment option. Study limitations include lack of a power analysis, small sample size, limited follow-up, lack of an active comparator, and lack of blinding of outcome assessors.

PelloGraft

Studies are lacking regarding the use of PelloGraft for wound treatment. Therefore, it is not possible to conclude whether PelloGraft has a beneficial effect on health outcomes.

PelloGraft (Surgenex) is a dual layer amniotic/chorionic membrane allograft. PelloGraft functions as a barrier and provides protective coverage to acute and chronic wounds.

PermeaDerm B, PermeaDerm Glove or PermeaDerm C

There are few published studies addressing the use of PermeaDerm B, PermeaDerm Glove or PermeaDerm C for any other indications. Therefore, it is not possible to conclude whether PermeaDerm B, PermeaDerm Glove or PermeaDerm C have a beneficial effect on health outcomes.

PermeaDerm B, PermeaDerm C and PermeaDerm Glove (Stedical Scientific) are identical in chemical composition and 3D structure. They are all composed of a monofilament nylon knitted fabric bonded to a thin slitted silicone membrane. The nylon side of this dressing is coated with a mixture of hypoallergenic porcine gelatin and a pure fraction of aloe vera The physical differences in the two configurations (PermeaDerm B versus PermeaDerm C and PermeaDerm Glove) are in the number and orientations of slits per unit area.

- PermeaDerm B is indicated for partial thickness burn wounds, donor sites and coverage of meshed autograft.
- PermeaDerm C is indicated for partial thickness wounds, pressure sores, venous ulcers, diabetic ulcers, chronic vascular ulcers, surgical wounds (donor sites/grafts, post-Moh's, post-laser surgery, podiatric, wound dehiscence, trauma wounds (abrasions, lacerations, second-degree burns, and skin tears) and draining wounds.
- PermeaDerm Glove is indicated for debrided partial thickness hand burns.

Phoenix Wound Matrix

There are few published studies addressing the use of Phoenix Wound Matrix for any other indications. Therefore, it is not possible to conclude whether Phoenix Wound Matrix has a beneficial effect on health outcomes.

The Phoenix Wound Matrix (Nanofiber Solutions) is a sterile, single use device intended for the management of wounds. The Phoenix Wound Matrix is a conformable, non-woven, fibrous, three-dimensional matrix. The Phoenix Wound Matrix is made from two types of polymer fibers: Poly(lactide-co-caprolactone) and Polyglycolic acid, which are bio-absorbed after degrading via hydrolysis. It is intended for use in the management of wounds. Wound types include: partial and full thickness wounds, pressure ulcers, venous ulcers, diabetic ulcers, chronic vascular ulcers, tunneled/undermined wounds, surgical wounds (donor sites/grafts, post-Moh's surgery, post laser surgery, podiatric, wound dehiscence), trauma wounds (abrasions, lacerations, second degree burns, skin tears) and draining wounds.

Polycyte

There are few published studies addressing the use of Polycyte for any other indications. Therefore, it is not possible to conclude whether Polycyte has a beneficial effect on health outcomes.

Polycyte (Predictive Biotech) is a minimally manipulated human tissue allograft derived from the Wharton's jelly of the umbilical cord. It is intended for use in repair, reconstruction, replacement or supplementation of cells or tissue.

PriMatrix

There are several studies related to PriMatrix, all with study limitations. Although the evidence for this product is somewhat favorable, there is limited evidence related to the safety and long-term outcomes of this product.

PriMatrix (Integra Life Sciences, Inc.) is a bovine derived acellular dermal matrix indicated for the treatment of a variety of wounds.

An ECRI report for PriMatrix Dermal Repair Scaffold for treating a variety of wounds (i.e., partial and full-thickness wounds; pressure, diabetic, and venous ulcers; second-degree burns; surgical, trauma, and draining wounds; tunneled/undermined wounds) indicated that evidence is inconclusive based on two small nonrandomized studies and four case series. **One small study indicated that PriMatrix resulted in faster healing than Apligraf, but there is**

limited data and too high risk of bias to draw conclusions. All studies need validation in larger randomized trials that report more long-term effects (ECRI, 2019).

Sabolinski and Gibbons (2018) compared the effectiveness of bi layered living cellular construct (BLCC; Apligraf) and an acellular fetal bovine collagen dressing (FBCD; PriMatrix) for the treatment of venous leg ulcers. Data an electronic medical record (EMR) database was used to analyze 1,021 refractory venous leg ulcers treated at 177 facilities. Kaplan-Meier analyses showed that BLCC (893 wounds) was superior to FBCD (128 wounds) for: wound closure by weeks 12 (31 vs 25%), 24 (55 vs 43%) and 36 (68 vs 53%); reduction in time to wound closure of 37%, (19 vs 30 weeks); and improvement in the probability of healing by 45%. The authors concluded that BLCC versus FBCD showed significant differences in both time to and frequency of healing. A limitation of this study is that the use of EMR databases to collect data may introduce some reporting differences between or within centers. Information made available from all participating centers may not reflect uniform standards of ~~patient~~ **individual** assessments and standardization of general wound care practices.

Procenta

There are few published studies addressing the use of Procenta for wound treatment. Therefore, it is not possible to conclude whether Procenta has a beneficial effect on health outcomes.

Procenta (Lucina BioSciences, LLC) is an acellular, sterile, human placental-derived allograft. It is indicated to treat chronic non-healing wounds, such as venous stasis ulcers to assist in the wound healing process.

ProgenaMatrix

There are few published studies addressing the use of ProgenaMatrix. Therefore, it is not possible to conclude whether ProgenaMatrix has a beneficial effect on health outcomes.

ProgenaMatrix (Cell Constructs I, LLC) is a graft matrix composed of human keratin proteins selectively extracted from human hair. This product is intended for treatment of dry and exuding partial and full thickness wounds.

ProMatrX

There are few published studies addressing the use of ProMatrX for wound treatment. Therefore, it is not possible to conclude whether ProMatrX has a beneficial effect on health outcomes.

ProMatrX ACF™ (Amnio Technology, LLC) is a human allograft comprised of amnion and amniotic fluid that is intended to provide a liquid allograft to aid in the healing and repair of chronic wounds.

PuraPly, PuraPly AM (~~f~~Formerly ~~c~~Called FortaDerm), or PuraPly XT

There are several studies related to PuraPly, PuraPly AM (formerly called FortaDerm), or PuraPly XT, all with study limitations. Therefore it is not possible to conclude whether PuraPly, PuraPly AM (formerly called FortaDerm), or PuraPly XT has a beneficial effect on health outcomes.

PuraPly (Organogenesis, Inc.) is a dressing made of porcine intestinal collagen matrix that is coated with polyhexamethylene biguanide hydrochloride (PHMB) antimicrobial agent. It is intended for wound care management.

Bain et al. (2020) evaluated the effectiveness of purified native type I collagen matrix plus polyhexamethylene biguanide antimicrobial (PCMP) (PuraPly AM) on cutaneous wounds by conducting a prospective cohort study of 307 ~~patients~~ **individuals** (67 venous leg ulcers, 62 diabetic foot ulcers, 45 pressure ulcers, 54 postsurgical wounds and 79 other wounds). Cox wound closure for PCMP was 73% at week 32. The median time to wound closure was 17 weeks (Kaplan-Meier). The incidence of PCMP-treated wounds showing > 60% reductions in areas, depths and volumes were 81, 71 and 85%, respectively. The authors concluded that PCMP demonstrated clinically meaningful benefits to ~~patients~~ **individuals** with various types of cutaneous wounds. This study is limited because there was no comparator treatment group.
A Hayes report on PuraPly indicated that the quantity of published, peer-reviewed clinical data is insufficient to evaluate PuraPly AM for chronic lower extremity ulcers in a full assessment. [Hayes, PuraPly Antimicrobial (AM) Wound Matrix (Organogenesis Inc.) for Treatment of Wounds, 2022].

A 2022 ECRI report for PuraPly AM Antimicrobial Wound Matrix for treating chronic wounds indicates that evidence is inconclusive. Three small cases series with a high risk of bias noted that PuraPly AM along with standard wound care achieved complete wound closure in about one-third to two-thirds of chronic wounds with different etiologies within 5 to 7 weeks. The studies are at a very high risk of bias due to small sample size, single center, lack of controls, binding and randomization. The studies were lacking in long-term outcomes and ~~patient~~**individual**-oriented outcomes. Large multicenter ~~randomized controlled trials~~**RCTs** are needed that address long-term and cosmetic outcomes as well as complications.

Rebound Matrix

Studies are lacking regarding the use of Rebound Matrix for wound treatment. Therefore, it is not possible to conclude whether Rebound Matrix has a beneficial effect on health outcomes.

Rebound Matrix (Sequence LifeScience, Inc.) is a full thickness minimally manipulated human placental membrane product derived from donated placental tissues that retain the structural and functional characteristics of the tissues. Rebound™ Matrix is composed of extracellular matrix proteins and serves as a natural, biological barrier or wound cover. The typical patient population includes those with chronic full thickness ulcers and other skin defects where a biological barrier or cover is required.

Reeva FT

Studies are lacking regarding the use of Reeva FT for wound treatment. Therefore, it is not possible to conclude whether Reeva FT has a beneficial effect on health outcomes.

Reeva FT (Legacy Medical Consultants) is a dehydrated resorbable allograft derived from donated human placental birth tissue that is applied over the wound and serves as a barrier and protective covering from the surrounding environment to acute and chronic wounds.

RegeneLink Amniotic Membrane Allograft

Studies are lacking regarding the use of RegeneLink Amniotic Membrane Allograft for wound treatment. Therefore, it is not possible to conclude whether RegeneLink Amniotic Membrane Allograft has a beneficial effect on health outcomes.

RegeneLink Amniotic Membrane Allograft (LifeLink Foundation, Inc.) is a sterile, lyophilized, gamma irradiated, full thickness allograft which includes amnion and chorion derived from donated human placenta. RegeneLink Amniotic Membrane Allograft is intended for use as a protective covering or barrier for internal and external tissue defects.

REGUaRD

~~There are no published~~ **There are few published** studies addressing the use of REGUaRD. Therefore, it is not possible to conclude whether REGUaRD has a beneficial effect on health outcomes.

REGUaRD (New Life Medical, LLC) is a hydrated acellular (human) dermal allograft matrix used for the treatment of non-healing wounds and bum injuries. It contains extracellular matrix (ECM) that provides a scaffold for cellular ingrowth vascularization, tissue regeneration and formation of granulation tissue.

Relese

~~There are no published~~ **There are few published** studies addressing the use of Relese for wound treatment. Therefore, it is not possible to conclude whether Relese has a beneficial effect on health outcomes.

Relese™ is a sheet skin substitute product that contains non-viable cells and is intended for use as a selective barrier and to protect wounds from the surrounding environment for chronic and acute wounds including dermal ulcers and other defects.

RenoGraft

Studies are lacking addressing the use of RenoGraft. Therefore, it is not possible to conclude whether RenoGraft has a beneficial effect on health outcomes.

RenoGraft **(Surgenex)** is a triple layer amniotic/chorionic membrane allograft. RenoGraft functions as a barrier and provides protective coverage to acute and chronic wounds.

Repriza

There are few published studies addressing the use of Repriza. Therefore, it is not possible to conclude whether Repriza has a beneficial effect on health outcomes.

Repriza (Promethean Life Sciences, Inc) is an acellular dermal matrix prepared from human skin allograft. Repriza is intended for implantation for reconstructive surgery wherever an acellular dermal matrix may be used, for example in abdominal wall reconstruction, and augmentation of soft tissue irregularities.

Cockcroft and Markelov (2018) followed 11 ~~patients~~**individuals** in a retrospective cohort study for a minimum of 6 weeks (mean, 12 weeks). The ~~patients~~**individuals** had undergone a trapeziectomy with interpositional arthroplasty using Repriza acellular dermal matrix to treat primary and secondary carpometacarpal joint arthritis. Subjective and objective data were collected to assess pain, subjective improvement of symptoms, radiographic measurements of first metacarpal subsidence, key pinch strength, grip strength, and range of motion. Early outcomes compared favorably to other treatment series. On average, ~~patients~~**individuals** received a significant pain reduction of 63%, with 36% of ~~patients~~**individuals** admitting to complete pain resolution. All ~~patients~~**individuals** had an overall subjective improvement in symptoms. Ninety-one percent of ~~patients~~**individuals** achieved postoperative opposition of the thumb and fifth digit. Comparison with preoperative x-rays showed mean thumb metacarpal subsidence of 27%. Zigzag deformity and extra-articular acellular dermal matrix migration, due to lack of patient compliance with splint, were observed complications. The authors concluded that this technique is safe and effective for Eaton grades III and IV thumb carpometacarpal arthritis. Long-term study with a larger sample size are needed to investigate this technique further.

Restorigin

There are few published studies addressing the use of Restorigin. Therefore, it is not possible to conclude whether Restorigin has a beneficial effect on health outcomes.

The Restorigin Amnion Patch (Parametrics Medical) is derived from the amnion layer of fetal membranes in the umbilical cord. It is intended to provide protection as well as a tissue matrix to reduce inflammation and scarring for individuals with chronic, non-healing wounds and burns.

Restrata or Restrata MiniMatrix

There are limited studies addressing the use of Restrata and/or Restrata MiniMatrix. Therefore, it is not possible to conclude whether Restrata and/or Restrata MiniMatrix have a beneficial effect on health outcomes.

Restrata is a synthetic, resorbable fiber matrix that resembles human extracellular matrix (ECM) and acts as a scaffold material the body uses for revascularization and soft tissue regeneration. It is intended to treat wounds such as venous, and pressure ulcers, as well as second-degree burns and other traumatic wounds.

Restrata MiniMatrix (Acera Surgical, Inc.) is comprised of micronized electrospun fiber matrix (particulate less than 3.15 mm in diameter), offering a dispersible form factor of Restrata that may be applied to soft tissue areas with irregular or complex topography. It is intended for use in the management of wounds, including: Partial and full thickness wounds, pressure sores / ulcers, venous ulcers, chronic vascular ulcers, tunneled / undermined wounds, surgical wounds (e.g., donor site / grafts, post-laser surgery, post-Mohs surgery, podiatric wounds, dehisced wounds), trauma wounds (e.g., abrasions, lacerations, partial thickness burns, skin tears), and draining wounds.

An ECRI report for Restrata Resorbable Wound Matrix (Acera Surgical) for Treating Acute and Surgical Wounds for Treating Complex and Chronic Wounds indicates that the evidence for Restrata is inconclusive. There is very

low quality evidence that Restrata promotes wound healing of chronic DFUs. The studies have a very small sample size to be conclusive and there is a high risk of bias. RCTs are needed to validate these findings comparing Restrata to other advanced wound care products (ECRI 2024)

An ECRI report for Restrata Resorbable Wound Matrix (Acera Surgical) for Treating Acute and Surgical Wounds for Treating Acute and Surgical Wounds indicates that the evidence for Restrata is inconclusive. There is very low quality evidence that Restrata promotes wound healing in surgical wounds. But the studies have a very small sample size to be conclusive and there is a high risk of bias. RCTs are needed to validate these findings comparing Restrata to other advanced wound care products (ECRI 2024)

Regulski and MacEwan (2018) conducted a retrospective review in a single center to evaluate the efficacy and utility of the implantable nanomedical scaffold in the treatment of chronic, nonhealing lower extremity wounds in ~~patients~~individuals with multiple comorbidities. Data were retrospectively collected via chart review by the treating physician. A total of 82 wounds were included in this study; wound types consisted of 34 diabetic foot ulcers, 34 venous leg ulcers, and 14 other wounds. Overall, treated wounds demonstrated progressive and sustained wound area reduction over the course of treatment, with 85% achieving complete closure at 12 weeks. Limitations included the following: this was an initial review of the implantable nanomedical scaffold and lack of a control group and randomization, which limit the ability to draw conclusions about the effectiveness of the scaffold. Additional research is needed along with large, randomized control studies to further predict efficacy and safety.

Revita

There are few published studies addressing the use of Revita. Therefore, it is not possible to conclude whether Revita has a beneficial effect on health outcomes.

Revita (StimLabs, LLC) is a sterilized, dehydrated human placental allograft. It is intended to be used as a wound covering, or barrier membrane, over chronic and acute wounds, including dermal ulcers. It also has clinical applications in dentistry, ophthalmology, and orthopedics.

Revitalon

There are few published studies addressing the use of Revitalon for wound treatment. Therefore, it is not possible to conclude whether Revitalon has a beneficial effect on health outcomes.

Revitalon (Medline Industries, Inc.) is a minimally processed amniotic membrane proposed for the treatment of chronic, non-healing wounds.

RevoShield+ Amniotic Barrier

Studies are lacking regarding the use of RevoShield+ Amniotic Barrier for wound treatment. Therefore, it is not possible to conclude whether RevoShield+ Amniotic Barrier has a beneficial effect on health outcomes.

RevoShield+ Amniotic Barrier (4Front Strategic Partners, Surgenex, LLC) is a minimally manipulated dual layer tissue-based product derived from the amniotic membrane of the human placenta. Following preparation of the wound (e.g., excision and debridement), the RevoShield + Amniotic Barrier is applied over the wound. The intended use of the RevoShield + Amniotic Barrier is to serve as a barrier or to provide protective coverage from the surrounding environment for acute and chronic wounds.

SanoGraft

Studies are lacking addressing the use of SanoGraft. Therefore, it is not possible to conclude whether SanoGraft has a beneficial effect on health outcomes.

SanoGraft (Surgenex) is a dehydrated single layer amnion membrane allograft that is intended to function as a barrier and provides protective coverage to acute and chronic wounds.

Sanopellis

Studies are lacking addressing the use of Sanopellis. Therefore, it is not possible to conclude whether Sanopellis has a beneficial effect on health outcomes.

Sanopellis (ReNu LLC) is an amniotic membrane product used as a wound covering and to act as a barrier for full and partial-thickness, chronic and acute wounds.

Signature APatch

~~There are no published~~ **There are few published** studies addressing the use of Signature APatch for wound treatment. Therefore, it is not possible to conclude whether Signature APatch has a beneficial effect on health outcomes.

Signature APatch (Signature Biologics) is a cryopreserved tissue derived from amniotic membrane for homologous use as a wound covering. Signature APatch can separate the underlying tissue from the external environment.

SimpliGraft or SimpliMax

Studies are lacking regarding the use of *SimpliGraft or SimpliMax* for wound treatment. Therefore, it is not possible to conclude whether *SimpliGraft or SimpliMax* has a beneficial effect on health outcomes.

SimpliGraft (Xtant Medical) is a single-layer amniotic membrane obtained from healthy deliveries following informed consent that is intended to serve as a barrier and provide protective coverage from the surrounding environment when topically applied to chronic and acute wounds.

SimpliMax (Xtant Medical) is a dual-layer amniotic membrane obtained from healthy deliveries following informed consent. SimpliMax is intended to serve as a barrier and provide protective coverage from the surrounding environment when topically applied to chronic and acute wounds.

Singlay

Studies are lacking regarding the use of Singlay for wound treatment. Therefore, it is not possible to conclude whether Singlay has a beneficial effect on health outcomes.

Singlay (Samaritan Biologics LLC) is a perforated single layer amnion derived allograft to serve as a barrier and provide protective coverage from the surrounding environment to acute and chronic wounds.

SkinTE

There are few published studies addressing the use of SkinTE for wound treatment. Therefore, it is not possible to conclude whether SkinTE has a beneficial effect on health outcomes.

SkinTE (PolarityTE, Inc.) is a fully autologous, homologous skin product intended to be used for the repair, reconstruction, replacement, supplementation, or regeneration of defects or functional losses of the skin. SkinTE is manufactured from a harvested sample of the **individual** ~~patient~~'s full-thickness skin, composed of viable skin cells and an organized extracellular matrix, with no additional cell or tissue source from another human (allogeneic) or different species (xenogeneic). The product is intended for treatment of acute burns requiring excision, grafting, and chronic wounds.

An ECRI report for SkinTE for Treating Acute and Chronic Wounds indicated that the evidence for SkinTE is inconclusive because no evidence is available (ECRI, 2018).

STRATTICE

There are several studies related to STRATTICE, all with study limitations. Therefore, it is not possible to conclude whether STRATTICE has a beneficial effect on health outcomes.

STRATTICE (Allergan) is a porcine derived acellular dermal biological mesh intended for use as a soft tissue patch to reinforce soft tissue where weakness exists and for the surgical repair of damaged or ruptured soft tissue membranes. It

is intended for the repair of hernias and/or body wall defects which require the use of reinforcing or bridging material to obtain the desired surgical outcome.

Jakob et al. (2020) conducted a two-arm randomized study to compare the outcome after prophylactic, intraperitoneal implantation of a biologic STRATTICE mesh with standard abdominal closure in ~~patients~~ **individuals** undergoing emergency abdominal surgery. ~~Patients~~ **Individuals** were randomly assigned to prophylactic implantation of a biological intraperitoneal mesh using STRATTICE (mesh group) or standard abdominal closure using a single, continuous running suture (no mesh group). Because of safety concerns, ~~patient~~ **individual** enrollment had to be closed prematurely. Eligibility for inclusion was assessed in 61 ~~patients~~ **individuals**. A total of 48 ~~patients~~ **individuals** were randomized (21 in the mesh group, 28 in the no-mesh group). No differences in baseline characteristics were found. Abdominal wall complications requiring re-operations were more frequent in the mesh group compared to the no mesh group [5 of 13 (83.3%) vs. 1 of 13 (14.3%) ~~patients~~ **individuals**, p = 0.026]. Mesh-associated abdominal wall complications included non-integration of the mesh into the abdominal wall, dissolution of the mesh, and mesh-related infections. The investigators concluded that in ~~patients~~ **individuals** undergoing emergency abdominal surgery, intraperitoneal biologic STRATTICE mesh implantation is associated with significantly more frequent abdominal wall complications requiring re-operation. Therefore, the use of such meshes cannot be recommended in the contaminated environment of emergency abdominal surgery.

In a cohort study, Kaufmann et al. (2020) evaluated the clinical efficacy and **individual** ~~patient~~ satisfaction following STRATTICE placement in complex abdominal wall hernia repair (CAWHR). The aim of this study was to evaluate clinical efficacy and **individual** ~~patient~~ satisfaction following STRATTICE™ placement in ~~patients~~ **individuals** treated for CAWHR in three academic and peripheral hospitals in Germany. ~~Patients~~ **Individuals** underwent abdominal examination, an ultrasound was performed, and ~~patients~~ **individuals** completed quality-of-life questionnaires. Twenty-seven ~~patients~~ **individuals** were assessed (14 male, age 67.5 years, follow-up 42.4 months). The most frequent postoperative complication was wound infection (39.1%). STRATTICE did not have to be removed in any of the ~~patients~~ **individuals**. Four ~~patients~~ **individuals** had passed away. During outpatient clinic visit, six out of 23 ~~patients~~ **individuals** (26.1%) had a recurrence of hernia, one patient had undergone reoperation. Five ~~patients~~ **individuals** (21.7%) had bulging of the abdominal wall. Quality-of-life questionnaires revealed that ~~patients~~ **individuals** judged their scar with a median 3.5 out of 10 points (0 = best) and judged their restrictions during daily activities with a median of 0 out of 10.0 (0 = no restriction). The investigators indicated that despite a high rate of wound infection, no biological mesh had to be removed. According to the authors, in some cases the biological meshes provided a safe way out of desperate clinical situations. Both the recurrence rate and the amount of bulging were high (failure rate 47.8%). Since the design of this study is a cross-sectional cohort study, data were partly retrospective and partly prospectively collected. This could have led to a bias in the study results.

Maxwell et al. (2019) used a prospectively maintained database to compare Fortiva, STRATTICE, and Alloderm acellular dermal matrices (ADMs) in abdominal wall reconstruction (AWR). Hernia recurrence and surgical site occurrence (SSO) were the primary and secondary endpoints. Kaplan-Meier survival curves and logistic regression models were used to evaluate risks for hernia recurrence and SSO. A total of 229 ~~patients~~ **individuals** underwent AWR with 1 of 3 ADMs. Median follow-up time was 20.9 months (1-60 months). Cumulative recurrence rates for each mesh were 6.9%, 11.2%, and 22.0% for Fortiva, STRATTICE, and Alloderm groups. Surgical site occurrence for each mesh was 56.9%, 49.0%, and 49.2%, respectively. Seroma was significantly lower in the Fortiva group (1.4%). Independent risk factors hernia recurrence included body mass index of 30 kg/m or higher and hypertension. Adjusted risk factors included oncologic resection for hernia recurrence and a wound class of contaminated or dirty/infected for SSO. The authors concluded that acellular dermal matrices provide a durable repair with low overall rate of recurrence and complications in AWR. The study found that the recurrence and complication profiles differ between brands. These results need to be confirmed by prospective randomized trials. The limitation of this study is the absence of a control arm to compare biological mesh reconstruction with other techniques of abdominal wall reconstruction.

Trippoli et al. (2018) conducted a meta-analysis to evaluate the treatment of primary and incisional ventral hernia using biologic meshes. The study consisted of the following phases: a) Identification of the biologic meshes available on the market; b) Literature search focused on efficacy and safety of these meshes; c) Analysis of the findings derived from the literature search. The information was reviewed and presented according to standard meta-analysis. The main endpoints of the analysis included infection of surgical wound at 1 month and recurrence at 12 months. Eleven trials that evaluated 5 biological meshes were identified: Permacol (706 ~~patients~~ **individuals**), STRATTICE (324 ~~patients~~ **individuals**), Surgisis (44 ~~patients~~ **individuals**), Tutomesh (38 ~~patients~~ **individuals**) and Xenmatrix (22 ~~patients~~ **individuals**). These studies

generally showed a poor methodological quality, and surgical wound infection showed wide range between studies variability. A significantly lower rate of recurrence at 12 months was found for Permacol compared with STRATTICE. The authors concluded that the different types of meshes showed a marked statistical variability in the clinical outcomes, and nearly all comparisons between different meshes in the two clinical endpoints did not reach statistical significance. These findings are in line with those of a recent consensus review from a European working group (Köckerling et al., 2018) that does not recommend the routine use of biologic meshes for abdominal wall reconstruction. The study conducted by Huntington et al., 2016 which was previously cited in this policy is included in the Trippoli et al., 2018 meta-analysis.

Stravix and StravixPL

There are ~~several~~ few published studies related to Stravix and StravixPL, all with study limitations. Therefore, it is not possible to conclude whether Stravix and/or StravixPL has a beneficial effect on health outcomes.

Stravix and StravixPL (Osiris Therapeutics, Inc.) are thicker versions of Grafix PRIME and GrafixPL PRIME. These products use umbilical amnion and Wharton's Jelly to support wound repair. Stravix and StravixPL are intended for treating ulcers, burns, pyoderma gangrenosum, epidermolysis bulosa, and other types of wounds.

A~~n~~ **2021** ECRI report for Stravix Cryopreserved Placental Tissue (Osiris Therapeutics, Inc.) is a ready-to-use, cryopreserved amniotic membrane graft derived from human placenta and is intended for treating wounds and repairing connective tissue defects. The graft is purported to be minimally processed to retain the amnion's native cells and extracellular matrix. Stravix is intended as a substitute for skin autografts when harvesting skin is infeasible, impractical, or risky to the **individual** ~~patient~~. **This report indicates that there is a single small case series provides too little evidence to determine how well Stravix works to treat surgical wounds or how it compares with other skin substitutes.**

Supra SDRM

~~There are no published~~ **There are few published** studies addressing the use of Supra SDRM for wound treatment. Therefore, it is not possible to conclude whether Supra SDRM has a beneficial effect on health outcomes.

SUPRA SDRM® is a novel synthetic, guided wound closure matrix, built as a bimodal foam membrane structure for the management of chronic wounds.

SUPRATHEL

There are several studies related to SUPRATHEL, all with study limitations. Therefore, it is not possible to conclude whether SUPRATHEL has a beneficial effect on health outcomes.

SUPRATHEL® is indicated in superficial (2a°) and deep dermal/partial thickness (2b°) skin loss diseases, such as burn wounds, split-thickness skin graft (STSG) donor sites, as well as trauma and surgical wounds.

An ECRI 2023 clinical evidence assessment for SUPRATHEL for Treating Burns suggest that SUPRATHEL is safe, yet the studies are at high risk for bias and there are too few ~~patients~~ **individuals** per comparison to make the findings conclusive about the comparative effectiveness.

An ECRI 2021 clinical evidence assessment for SUPRATHEL Skin Substitute (PolyMedics Innovations GmbH) for Treating Donor Site Wounds suggest that SUPRATHEL is safe, but whether it improves **individual** ~~patient~~ outcomes compared with other dressings cannot be determined because available studies are at high risk of bias and assess too few ~~patients~~ **individuals** per comparison. There was one randomized controlled trial (RCT) and 2 comparison studies. Comparison multicenter RCTs comparing SUPRATHEL with other donor site wound treatments that report on pain, infection rates, and wound healing are needed to assess comparative effectiveness, but none are ongoing. (Schwarz 2007 and Markl 2010 are included in this report).

Blome-Eberwein et al. (2021) in a retrospective chart review from a single center burn center reviewed SUPRATHEL, a new bio-degradable synthetic membrane that was recently introduced to treat second degree burns in adults and pediatric ~~patients~~ **individuals**. There were 229 burn ~~patients~~ **individuals** [141 male, 88 females, (138 pediatric)] with a mean age

of 18 years (9 weeks to 73 years) were included in the study. 474 sheets of the synthetic membrane were applied to second degree burns (superficial and deep). The average burn size was 8.9% (range 1 to 60% TBSA. The wound bed was prepped with either rough debridement or dermabrasion. After hemostasis, the membrane was applied to the wound with an outer dressing of fatty gauze, bridal veil, absorptive gauze followed by an ACE® wrap. The outer dressing was removed every one to four days, depending on exudate, in order to closely follow the wound through the translucent membrane and fatty gauze layers. After epithelialization, the dressing separated and could be removed. The study focused on the need for subsequent grafting, healing time, **individual** ~~patient~~ pain level, hypertrophic scarring and rate of infection. All wounds in this study that were treated with SUPRATHEL® healed without grafting. The average TBSA (Total Body Surface Area) was 8.9% (1%-60%). Average time to healing was 13.7 days for ≥ 90% epithelialization with 11.9 days for pediatric ~~patients~~ **individuals** versus 14.7 days for adults. Throughout the treatment period, the average pain level was 1.9 on a 10-point scale. 27 ~~patients~~ **individuals** developed hypertrophic scarring in some areas (11.7%). Average length of stay (LOS) was 6.9 days. The rate of infection was 3.8% (8/229). Failure or progression to full thickness in part of the wounds was 5.2% (12/229). Limitations were that of any retrospective study in addition to no control group. Authors note that SUPRATHEL is a good treatment option when treating second degree burns. It's a basic treatment that provides a physiologic healing environment with good outcomes and less pain than previously used options used by the providers at the same institution. Authors indicate that a prospective long-term outcome study with control group is in preparation to confirm these preliminary findings.

Hundeshagen et al. (2018), in a prospective single center randomized controlled trial, compared Mepilex Ag (M), a silver-impregnated foam dressing, and SUPRATHEL (S), a DL-lactid acid polymer, in the outpatient treatment of partial-thickness burns in pediatric and adult ~~patients~~ **individuals**. Re-epithelialization, wound pain and discomfort during dressing changes were observed. Objective scar characteristics (elasticity, transepidermal water loss, hydration, and pigmentation) and subjective assessments (Patient and Observer Scar Assessment Scale) were measured at 1 month post burn. Data are presented as mean ±SEM, and significance was accepted at $p < 0.05$. Sixty-two ~~patients~~ **individuals** (S n = 32; M n = 30) were enrolled; age, sex, and burn size were comparable between the groups. Time to re-epithelialization was not different between the groups (12 days; $p = 0.75$). Pain ratings were significantly reduced during the first 5 days after burn in the SUPRATHEL group in all ~~patients~~ **individuals** ($p = 0.03$) and a pediatric subgroup ($p < 0.001$). Viscolelasticity of burned skin was elevated compared with unburned skin in the Mepilex Ag group at 1 month post burn. ~~Patients~~ **Individuals** treated with SUPRATHEL reported better overall scar quality (S: 2; M: 4.5; $p < 0.001$). Both dressings are feasible and useful for the outpatient treatment of minor and selected moderate partial-thickness burns. Study limitations included results that were assessed by clinical judgement rather than objective assessment tools such as doppler, there were a number of participants that did not report at later points of the study and there was no blinding to the study personnel. Further studies on this treatment are warranted.

Markl et al. (2010), in an open label single-center randomized controlled trial, evaluated 3 different synthetic wound dressings for treating split-thickness skin graft donor sites. Seventy-seven participants were randomly assigned to 3 study groups: SUPRATHEL, Biatain-Ibu, Mepitel. Wounds were inspected daily until complete reepithelization. Ease of care and scar development after a 6-month follow-up were evaluated. SUPRATHEL showed significant ($p \leq 0.001$) pain reduction after 24 hours but increasing pain scores on the 5th day of treatment. Biatain-Ibu showed significant pain relief immediately after application and during the entire treatment period ($p < 0.05$). Mepitel did not show any significant pain reduction. There were no significant differences in the re-epithelization period of the 3 dressing materials. Further studies are warranted.

Schwarze et al. (2007) conducted a prospective, randomized, two center clinical study to evaluate the impact on wound healing of SUPRATHEL in donor sites of split-thickness skin grafts. SUPRATHEL represents an absorbable, synthetic wound dressing with properties of natural epithelium. Twenty-two burn ~~patients~~ **individuals** who were treated with split-thickness skin grafts, and with a mean age of 39.6 years were included in the study. Donor sites of skin grafts were randomly selected; partly treated with Jelonet and partly treated with SUPRATHEL. First gauze change was **doncudcted on**~~carried out~~ the fifth day postoperatively followed by regular wound inspection until complete re-epithelization. The study focused on **individual** ~~patient~~ pain score, healing time, analysis of wound bed and ease of care. No significant difference in healing time of the graft donor sites was detected between SUPRATHEL® and Jelonet. The mean 10-day pain score was 0.92 (median: 1.0; range: 0.2-1.8) in the SUPRATHEL® group, and 2.1 (median: 2.8; range: 0.4-3.0) in the Jelonet® group. These scores were statistically significant ($p = 0.0002$). There was a significantly lower pain score for ~~patients~~ **individuals** treated with SUPRATHEL ($p = 0.0002$). SUPRATHEL became transparent when applied and allowed close monitoring of wound healing. In contrast to Jelonet, SUPRATHEL showed excellent plasticity with better attachment and

adherence to wound surfaces. Throughout the healing process it detached from wounds without damaging the new epithelial surface. In addition, wound areas treated with SUPRATHEL required less frequent dressing changes. It also demonstrated ease of care. Limitations included a small sample size, lack of blinding, participants were their own control group (both dressings applied to different areas of the same wound) and subjective reporting outcomes. While these results are promising, larger robust studies are needed.

Surederm

There are few published studies addressing the use of Surederm. Therefore, it is not possible to conclude whether Surederm has a beneficial effect on health outcomes.

Surederm (HansBiomed Corp.) is a human acellular dermal matrix. It is intended to be used as skin reconstruction to repair skin loss from burns, wounds, congenital diseases, urinary incontinence, and ulcers or malformations.

SurFactor

There are few published studies addressing the use of SurFactor for wound treatment. Therefore, it is not possible to conclude whether SurFactor has a beneficial effect on health outcomes.

SurFactor (Surgenex, LLC) is an injectable amniotic membrane allograft that is packaged in sterile vials intended injection to the wound surface and supports wound healing and soft tissue repair.

SurgiCORD

There are few published studies addressing the use of SurgiCORD. Therefore, it is not possible to conclude whether SurgiCORD has a beneficial effect on health outcomes.

SurgiCORD (Synergy Biologics, LLC) is a human umbilical tissue membrane allograft that is intended to treat neuropathic ulcers, venous stasis ulcers, and post-traumatic and pressure ulcers.

SurgiGRAFT-DUAL

There are few published studies addressing the use of SurgiGRAFT-DUAL. Therefore, it is not possible to conclude whether SurgiGRAFT-DUAL has a beneficial effect on health outcomes.

SurgiGRAFT-DUAL (Synergy Biologics, LLC) is a bilayer human amniotic tissue allograft that is intended to be used to treat chronic, non-healing wounds including neuropathic ulcers, post-traumatic and pressure ulcers.

SurgiGRAFT

There are few published studies addressing the use of SurgiGRAFT. Therefore, it is not possible to conclude whether SurgiGRAFT has a beneficial effect on health outcomes.

SurgiGRAFT(Synergy Biologics, LLC) is a minimally manipulated human amnion-only regenerative extracellular tissue matrix derived from human placental tissue. It is intended for use in the following conditions: neuropathic ulcers, venous stasis ulcers, post-traumatic wounds, pre- and post- surgical wounds and pressure ulcers, diabetic wounds, burn wounds, scar tissue, scarring, and adhesion barrier up to and including nerve bundle and peripheral wrap as a wound covering.

SurGraft Products

There are few published studies addressing the use of SurGraft products. Therefore, it is not possible to conclude whether these SurGraft products have a beneficial effect on health outcomes.

SurGraft (Surgenex, LLC.) is a human amniotic membrane scaffold which is used as a wound covering and is intended for treating non-healing foot ulcers including diabetic, pressure and venous ulcers. The SurGraft family products include SurGraft, SurGraft ACA, SurGraft FT, SurGraft TL and SurGraft XT.

Symphony

There are few published studies addressing the use of Symphony. Therefore, it is not possible to conclude whether Symphony has a beneficial effect on health outcomes.

Symphony **(AROA)** is a bioengineered skin substitute that is composed of ~~ovine-derived~~ extracellular matrix (ECM) and hyaluronic acid (HA). It consists of three layers with more than 150 ECM proteins that aid in the wound healing process. It is intended for use in acute and chronic wounds.

TAG

There are few published studies addressing the use of TAG for wound treatment. Therefore, it is not possible to conclude whether TAG has a beneficial effect on health outcomes.

TAG (Conventus Flower Orthopedics, Inc.) is a sterile, dehydrated, triple layer amniotic allograft composed solely from the amniotic membrane of donated human placental tissue. TAG is intended to serve as a barrier and provide protective coverage from the surrounding environment for acute and chronic wounds.

Talymed

There are few published studies addressing the use of Talymed. Therefore, it is not possible to conclude whether Talymed has a beneficial effect on health outcomes.

Talymed **(Marine Polymer Technologies)** is a wound care management product composed of shortened fibers of poly-N-acetyl glucosamine (pGlcNAc) isolated from microalgae. It is indicated for the management of a range of serious, complex wounds.

Refer to the above section titled Systematic Reviews, Meta-Analyses, Guidelines, and Technology Assessments That Address Multiple Skin Substitutes for additional articles/reports that evaluate Talymed.

Kelechi et al. (2012) conducted a randomized controlled investigator blinded pilot study to evaluate the efficacy, safety, and tolerability of an advanced, poly-N-acetyl glucosamine (pGlcNAc), nanofiber-derived, wound-healing technology (Talymed) among ~~patients~~ **individuals** with venous leg ulcers (VLUs) compared to treatment with standard care plus pGlcNAc (applied only once, every other week, or every 3 weeks) or to standard care alone. The results showed among the 82 randomized ~~patients~~ **individuals**, 71 completed the study with 7 lost to follow-up and 4 discontinued because of systemic infection. There were no significant group differences with regard to baseline demographic, illness, and VLU characteristics. At 20 weeks, the proportion of ~~patients~~ **individuals** with completely healed VLUs was 45.0% (9 of 20), 86.4% (19 of 22), and 65.0% (13 of 20) for groups receiving standard care plus pGlcNAc only once, every other week, and every 3 weeks, respectively, versus 45.0% (9 of 20) for those receiving standard care alone. The advanced wound-healing technology was well tolerated and safe. The authors concluded that the results of this pilot study suggest that the pGlcNAc advanced wound-healing technology is well tolerated and effective. This study was limited by the small sample size and ~~patients~~ **individuals** unblinded to treatment allocation. Further research with ~~randomized controlled trials~~ **RCTs** is needed to validate these findings.

TenSIX

There are few published studies addressing the use of TenSIX. Therefore, it is not possible to conclude whether TenSIX has a beneficial effect on health outcomes.

The product information on TenSIX is not currently available.

TheraGenesis

There are few published studies addressing the use of TheraGenesis. Therefore, it is not possible to conclude whether TheraGenesis has a beneficial effect on health outcomes.

TheraGenesis is a bilayered wound matrix comprised of a biodegradable porcine tendon-derived atelocollagen layer and a silicone film layer. The collagen matrix acts as a scaffold material the body uses for revascularization and soft tissue

regeneration. The silicone layer contains a non-adhesive mesh that helps better adhere the matrix and chosen fixation to the wound. It is intended to treat wounds such as diabetic, venous, and pressure ulcers, as well as second-degree burns and other traumatic wounds.

An ECRI report for TheraGenesis Bilayer Wound Matrix (marketed as Pelnac outside the United States) for treating partial and full thickness wounds indicated that the evidence for this product is inconclusive due to too few data on outcomes of interest. While there was one blinded RCT, the study was small and heterogenous in the etiology of the wound. Larger studies are needed. (ECRI, 2023).

TheraMend

There are few published studies addressing the use of TheraMend for wound treatment. Therefore, it is not possible to conclude whether SurFactor has a beneficial effect on health outcomes.

TheraMend™ (Lux Therapeutics) is a patch product made from minimally processed, dehydrated amniotic membrane obtained from donated human tissue and is sterilized via gamma irradiation.

TheraSkin

There are several studies related to TheraSkin, all with study limitations. Although the evidence for this product is somewhat favorable, larger more robust studies are needed.

TheraSkin (Solsys™ Medical) is an extracellular dermal matrix proposed for multiple healing indications. It contains human collagen, fibroblasts, growth factors, keratinocytes and cytokines.

Refer to the above section titled Systematic Reviews, Meta-Analyses, Guidelines, and Technology Assessments That Address Multiple Skin Substitutes for additional articles/reports that evaluate TheraSkin.

An ECRI report for TheraSkin Human Skin Allograft indicated that the evidence for this product is inconclusive because there is not enough data. Evidence from three very small comparative studies and two case series needs validation in larger multicenter ~~randomized controlled trials~~**RCTs** that report patient-oriented outcomes and address each wound type to draw conclusions. Several large ongoing registry studies might provide some evidence to further elucidate the efficacy of TheraSkin allografts for treating various wound types. (ECRI, 2019).

In a pilot prospective, head-to-head, single site, randomized clinical trial, Towler et al. (2018; reviewed in ECRI report above) evaluated the effectiveness of 2 biologically active grafts, TheraSkin and Apligraf, in conjunction with compression therapy to treat venous leg ulcers (VLUs). The study, not industry-sponsored, was designed to assess differences in healing rates, and adverse outcomes. A total of 31 subjects were enrolled and randomized into 1 of the 2 cohorts. There were 4 subjects who were randomized but then dropped out of the study. The healing rates were different but not statistically significant and there were no adverse outcomes. According to the authors, this suggests that TheraSkin may provide equivalent or superior outcomes to Apligraf. This study is at risk of selection bias due to a small sample size. The authors indicated that because this is a pilot study, it was designed to only give a general feel for the differences in performance of these 2 treatment options.

Treadwell et al. (2018; reviewed in ECRI report above) conducted a real-world setting analysis to compare the effectiveness of a bioengineered living cellular construct (BLCC; Apligraf) to a cryopreserved cadaveric skin allograft (CCSA; TheraSkin) for the treatment of venous leg ulcers (VLUs). Treatment records were collected from a large wound care-specific electronic medical record database on 717 ~~patients~~**individuals** (799 VLUs) receiving treatment at 177 wound care centers. Ulcers ≥ 28 day's duration, between ≥ and ≤ 40 cm^2 that closed ≤ 40% within the 28 days before treatment were included. **Individual** ~~Patient~~ baseline demographics and wound characteristics were comparable between groups. The median time to wound closure was 52% faster with BLCC compared with CCSA (15 weeks vs. 31 weeks). In addition, the proportion of wounds healed was significantly higher for BLCC by 12 weeks (42% vs. 24%) and 24 weeks (65% vs. 41%). Treatment with BLCC increased the probability of healing by 97% compared with CCSA. According to the authors, this is the first real-world comparative effectiveness analysis to evaluate BLCC and CCSA for the treatment of VLUs. The authors concluded that treatment with a bioengineered cellular technology significantly improved the incidence and speed of wound closure compared with a CCSA. A limitation of this study is that the use of EMR databases to collect

data may introduce some reporting differences between or within centers. Information made available from all participating centers may not reflect uniform standards of **individual** ~~patient~~ assessments and standardization of general wound care practices.

Therion

There are few published studies addressing the use of Therion. Therefore, it is not possible to conclude whether Therion has a beneficial effect on health outcomes.

Therion (MISONIX) is a dehydrated and terminally sterilized allograft wound covering derived from human placental membrane used to treat chronic wounds.

Tri-Membrane Wrap

Studies are lacking regarding the use of Tri-Membrane Wrap for wound treatment. Therefore, it is not possible to conclude whether Tri-Membrane *Wrap* has a beneficial effect on health outcomes.

Tri-Membrane Wrap (BioLab Sciences) is a triple-layered human tissue allograft derived from the amniotic membrane that provides structural tissue for use as a wound and protectant covering.

TOTAL

Studies are lacking regarding the use of TOTAL for wound treatment. Therefore, it is not possible to conclude whether TOTAL has a beneficial effect on health outcomes.

TOTAL(Samaritan Biologics LLC) is a perforated amnion-chorion derived allograft to serve as a barrier and provide protective coverage from the surrounding environment to acute and chronic wounds.

TransCyte

TransCyte (Organogenesis, Inc.), formerly known as Dermagraft TC, is a human fibroblast-derived temporary wound cover consisting of human dermal fibroblasts grown on nylon mesh, combined with a synthetic epidermal layer. As the fibroblasts proliferate within the nylon mesh, they secrete human dermal collagen, matrix proteins and growth factors.

Pham et al. (2007) conducted a systematic review of skin substitutes for the management of burn injuries. A total of 20 ~~randomized controlled trials~~**RCTs** were included in the review. The evidence suggested that bioengineered skin substitutes, namely TransCyte, Biobrane, Dermagraft, and allogeneic cultured skin, were at least as efficacious as topical agents/wound dressings or allograft. The investigators indicated that there were several methodological limitations across the available studies, which hampered the overall conclusions. According to the investigators, additional well-designed ~~randomized controlled trials~~**RCTs** with sufficient long-term follow up are necessary to strengthen the overall evidence regarding the efficacy of tissue-engineered skin substitutes.

In a prospective, randomized, comparison study, Noordenbos et al. (1999) evaluated TransCyte, formerly marketed as Dermagraft-Transitional Covering, for the treatment of partial-thickness burns. A comparison study of silver sulfadiazine and TransCyte was performed with the use of paired wound sites on 14 ~~patients~~**individuals**. Wounds treated with TransCyte healed more quickly (mean 11.14 days to 90% epithelialization vs 18.14 days). A non-comparison evaluation was then done for an additional 18 ~~patients~~**individuals**, and it confirmed excellent wound healing and an absence of infections. There were no infections in the 32 wound sites treated with TransCyte. In the first study group, late wound evaluations (3, 6, and 12 months post-burn) were performed with use of the Vancouver Scar Scale. The results indicated that wound sites treated with TransCyte healed with less hypertrophic scarring than sites treated with silver sulfadiazine.

In a randomized prospective study, Demling and DeSanti (1999) compared the effect of standard topical antibiotic management versus a biological skin substitute wound closure (TransCyte) for mid-partial thickness burns of the face. Twenty-one adult ~~patients~~**individuals** with mid-dermal facial burns produced by flash flames or flame exposure were included in the study. Total daily burn care time, pain (0-10 scale) and healing time were monitored. Immediately after partial thickness debridement, the entire face burn, including ears, was closed with a bioengineered skin substitute coated with fibronectin (TransCyte) (n = 10) or treated by the open technique using bacitracin ointment applied 2-3 times daily (n

= 11). The authors found a significant decrease in wound care time (0.35 ±0.1 versus 1.9 ±0.5 h), decrease in pain of 2 ±1 versus 4 ±2 and re-epithelialization time (7 ±2 versus 13 ±4 days) in the skin substitute group compared to topical antibiotics group. The authors concluded that a bioengineered skin substitute significantly improves the management and healing rate of partial thickness facial burns compared to the standard open topical ointment technique.

TranZgraft

There are few published studies addressing the use of TranZgraft. Therefore, it is not possible to conclude whether this product has a beneficial effect on health outcomes.

TranZgraft (AZIYO® Biologics) is an acellular collagen matrix intended for repair of sports related injuries, including tendons and ligaments.

TruSkin

There are few published studies addressing the use of TruSkin for wound treatment. Therefore, it is not possible to conclude whether TruSkin has a beneficial effect on health outcomes.

TruSkin (Osiris Therapeutics, Inc) is a split-thickness, cryopreserved human skin allograft that is intended to treat acute and chronic wounds. It retains an extracellular matrix, rich supply of endogenous growth factors, and living skin cells.

Vendaje

~~There are no published~~ **There are few published** studies addressing the use of Vendaje. Therefore, it is not possible to conclude whether this product has a beneficial effect on health outcomes.

Vendaje (BioStem Technologies, Inc.) is a structural tissue allograft composed of the amnion layer of the placental membrane. Vendaje is intended for homologous use as a protective covering for soft tissue wounds.

Vendaje A

Studies are lacking regarding the use of Vendaje A for wound treatment. Therefore, it is not possible to conclude whether Vendaje A has a beneficial effect on health outcomes.

Vendaje A (BioStem Technologies, Inc.) is a decellularized human amniotic and chorionic allograft product derived from placental tissues and is intended for use as a protective covering for soft tissue wounds.

VIA Matrix

Studies are lacking regarding the use of VIA Matrix. Therefore, it is not possible to conclude whether VIA Matrix has a beneficial effect on health outcomes.

VIA Matrix (VIVEX Biologics) is a semi-transparent, collagenous membrane allograft obtained with consent from healthy mothers during cesarean section delivery. The VIA Matrix amnion allograft is a full thickness amnion-chorion allograft. The intended use of VIA Matrix includes the management of wounds, to protect wounds or burns from the surrounding environment to acute and chronic wounds.

Vim~~IM~~

~~There are no published~~ **There are few published** studies addressing the use of V**im**~~IM~~. Therefore, it is not possible to conclude whether this product has a beneficial effect on health outcomes.

V**im**~~IM~~™ is a dehydrated, decellularized, human amniotic membrane. It is derived from the placental amnion and includes epithelial and stromal components in a collagen-rich extracellular matrix. Vim contains extracellular proteins, such as collagen, glycoproteins, proteoglycans, cytokines, and growth factors that are important in extracellular matrix strength, cell attraction, and migration. It is indicated for use as a wound cover or barrier in ophthalmic, orthopedic, surgical, and other wound applications.

VitoGraft

Studies are lacking regarding the use of VitoGraft for wound treatment. Therefore, it is not possible to conclude whether VitoGraft has a beneficial effect on health outcomes.

VitoGraft (Surgenex) is a dehydrated, dual layer amnion membrane allograft that functions as a barrier and provides protective coverage to acute and chronic wounds.

WoundEx

There are few published studies addressing the use of WoundEx for wound treatment. Therefore, it is not possible to conclude whether WoundEx has a beneficial effect on health outcomes.

WoundEx (Skye Biologics, Inc.) is a dehydrated amniotic membrane skin substitute intended to be used as a wound covering in the treatment of chronic and acute wounds.

WoundEx Flow

There are few published studies addressing the use of WoundEx Flow for wound treatment. Therefore, it is not possible to conclude whether WoundEx Flow has a beneficial effect on health outcomes.

WoundEx Flow (Skye Biologics, Inc.) is a flowable human placental connective tissue matrix skin substitute intended to replace or supplement damaged or inadequate connective tissue. WoundEx Flow is processed using a proprietary technology that creates an ambient temperature flowable tissue allograft.p

WoundFix, WoundFix Plus, and WoundFix XPlus

There are few published studies addressing the use of WoundFix, WoundFix Plus, and WoundFix XpPlus. Therefore, it is not possible to conclude whether these products have a beneficial effect on health outcomes.

WoundFix, WoundFix Plus, and WoundFix XPlus (Human Regenerative Technologies, LLC) are single-layer, human tissue allografts derived from the human placenta and are intended for use as a wound covering, surgical covering, or wrap or barrier in acute and chronic wounds.

WoundPlus Membrane

There are few published studies addressing the use of WoundPlus Membrane for wound treatment. Therefore, it is not possible to conclude whether WoundPlus Membrane has a beneficial effect on health outcomes.

WoundPlus™ Membrane (Skye Biologics, Inc.) is a consists is a single layer amnion-only membrane allograft intended for use as a barrier, wrap or cover for acute and chronic wounds.

Xcell Amnio Matrix

There are few published studies addressing the use of Xcell Amnio Matrix for wound treatment. Therefore, it is not possible to conclude whether Xcell Amnio Matrix has a beneficial effect on health outcomes.

Xcell Amnio Matrix® (Precise Bioscience) is a lyophilized amniotic membrane allograft that is aseptically processed to preserve the native extracellular matrix and endogenous proteins. Xcell Amnio Matrix® acts as a barrier and provide protective coverage from the surrounding environment for acute and chronic wounds such as partial and full thickness wounds, pressure sores/ulcers, venous ulcers, diabetic ulcers, chronic vascular ulcers, tunneled/undermined wounds, surgical wounds, trauma wounds and draining wounds.

XCellerate

There are few published studies addressing the use of XCellerate for wound treatment. Therefore, it is not possible to conclude whether XCellerate has a beneficial effect on health outcomes.

XCellerate (Precise Bioscience) is a lyophilized amniotic membrane allograft intended for use in the treatment of non-healing wounds and burn injuries. It is available in several disc sizes and applied over the wound or burn site.

XCelliStem

There are few published studies addressing the use of XCelliStem for wound treatment. Therefore, it is not possible to conclude whether XCelliStem has a beneficial effect on health outcomes.

XCelliStem Wound Powder is a proprietary blend of multiple extracellular matrix materials derived from the multi-tissue platform (MTP) that maintains and supports a healing environment for wound management.

XCM BIOLOGIC

There are few studies addressing the use of XCM BIOLOGIC for the reinforcement of surgical procedures and repair of soft tissue. Therefore, it is not possible to conclude whether XCM BIOLOGIC has beneficial effects on health outcomes.

XCM BIOLOGIC (DePuy Synthes) is a sterile non-crosslinked 3D matrix derived from porcine dermis indicated for use in general surgical procedures for the reinforcement and repair of soft tissue where weakness exists.

XWRAP

There are few published studies addressing the use of XWRAP. Therefore, it is not possible to conclude whether XWRAP has a beneficial effect on health outcomes.

XWRAP (Applied Biologics, LLC) is a chorion-free amniotic membrane derived allograft. It is intended as a barrier or protective covering for tissue repair and reconstruction sites.

Zenith

~~There are no published~~ **There are few published** studies addressing the use of Zenith. Therefore, it is not possible to conclude whether this product has a beneficial effect on health outcomes.

Zenith™ Amniotic Membrane provides greater tensile strength, shape manipulation, and slower resorption in vivo. Placental tissue and membrane are known to contain collagen substrates, growth factors and extracellular matrix proteins recognized as part of the complex wound healing process.

Clinical Practice Guidelines

Wound Healing Society (WHS)

In evidence-based guideline for venous ulcers, the WHS stated that there is evidence that a bilayered living human skin equivalent, used in conjunction with compression bandaging, increases the incidence and speed of healing for venous ulcers compared with compression and a simple dressing (Level I evidence). The WHS recommends adequate wound bed preparation and control of excess bioburden levels prior to application of a biologically active dressing. They also noted that cultured epithelial autografts or allografts have not been demonstrated to improve stable healing of venous ulcers (Level I). The WHS also stated that there is Level II evidence that a porcine small intestinal submucosal construct may enhance healing of venous ulcers (Marston et al., 2016).

U.S. Food and Drug Administration (FDA)

This section is to be used for informational purposes only. FDA approval alone is not a basis for coverage.

Depending on their function and purpose, skin substitutes are regulated by the FDA through one of the following regulatory pathways:

- Premarket Approval (PMA): Devices that support or sustain human life or have the potential to cause risk of illness or injury are approved through the PMA process. These devices require clinical data to support their claims for use. Refer to the following website (search by product or applicant name): https://www.accessdata.fda.gov/scripts/cdrh/cfdocs/cfPMA/pma.cfm.

- Premarket Clearance or 510(k) Process: Devices that are substantively equivalent to legally marketed predicate devices that do not require PMA can be marketed under this designation. Refer to the following website (search by product or applicant name): https://www.accessdata.fda.gov/scripts/cdrh/cfdocs/cfPMN/pmn.cfm.
- FDA's Definition under the Code of Federal Regulations (CFR) of Human Cells, Tissues, and Cellular and Tissue-Based Products (HCT/P) addressed in Public Health Service 361 (Title 21, CFR 1270 & 1271): This pathway is available for biological tissue derived from human sources considered to be "minimally manipulated". Products that reach the market through the HCT/P process do not require any testing to prove clinical safety or efficacy. However, the manufacturer must meet specific FDA regulations for the collection, processing, and selling of HCT/Ps. Human amniotic membrane and amniotic fluid are included in these regulations. Human-derived tissue considered to be more than minimally manipulated require FDA premarket approval or 510(k) clearance. Refer to the following website for more information: https://www.fda.gov/vaccines-blood-biologics/tissue-tissue-products.
- Humanitarian Device Exemption (HDE): The regulatory pathway for products intended for diseases or conditions that affect small populations, or are rare. Refer to the following website for more information: https://www.accessdata.fda.gov/scripts/cdrh/cfdocs/cfHDE/hde.cfm
  (Accessed **June 24, 2024** ~~May 15, 2024~~)

References

Al Haddad E, LaPar DJ, Dayton J, et al. Complete atrioventricular canal repair with a decellularized porcine small intestinal submucosa patch. Congenit Heart Dis. 2018 Nov;13(6):997-1004.

Alomairi AA, Alhatlani RA, Alharbi SM, et al. Assessing the application and effectiveness of human amniotic membrane in the management of venous and diabetic ulcers: A systematic review and meta-analysis of randomized controlled trials. Cureus. 2024 Mar 21;16(3):e56659.

Bain MA, Koullias GJ, Morse K, et al. Type I collagen matrix plus polyhexamethylene biguanide antimicrobial for the treatment of cutaneous wounds. J Comp Eff Res. 2020 Jun 1.

Bianchi C, Cazzell S, Vayser D, et al. EpiFix VLU Study Group. A multicentre randomised controlled trial evaluating the efficacy of dehydrated human amnion/chorion membrane (EpiFix®) allograft for the treatment of venous leg ulcers. Int Wound J. 2018 Feb;15(1):114-122.

Bianchi C, Tettelbach W, Istwan N, et al. Variations in study outcomes relative to intention-to-treat and per-protocol data analysis techniques in the evaluation of efficacy for treatment of venous leg ulcers with dehydrated human amnion/chorion membrane allograft. Int Wound J. 2019 Jun;16(3):761-767.

Blome-Eberwein SA, Amani H, Lozano DD, et al. A bio-degradable synthetic membrane to treat superficial and deep second degree burn wounds in adults and children - 4 year experience. Burns. 2021 Jun;47(4):838-846.

Cazzell S. A randomized controlled trial comparing a human acellular dermal matrix versus conventional care for the treatment of venous leg ulcers. Wounds. 2019a Mar;31(3):68-74.

Cazzell S, Stewart J, Agnew PS, et al. Randomized controlled trial of micronized dehydrated human amnion/chorion membrane (dHACM) injection compared to placebo for the treatment of plantar fasciitis. Foot Ankle Int. 2018 Oct;39(10):1151-1161.

Cockcroft AC, Markelov AM. Trapeziectomy with interpositional arthroplasty using acellular dermal matrix: description of technique and early outcomes. Plast Reconstr Surg Glob Open. 2018 May 14;6(5):e1763.

Davison-Kotler E, Sharma V, Kang NV, et al. A Universal Classification System of Skin Substitutes Inspired by Factorial Design. Tissue Eng Part B Rev. 2018 Aug;24(4):279-288. doi: 10.1089/ten.TEB.2017.0477.

Davidson A, Jina NH, Marsh C, et al. Do functional keratin dressings accelerate epithelialization in human partial thickness wounds? A randomized controlled trial on skin graft donor sites. Eplasty. 2013 Aug 29;13:e45.

Debels H, Hamdi M, Abberton K, et al. Dermal matrices and bioengineered skin substitutes: a critical review of current options. Plast Reconstr Surg Glob Open. 2015 Feb 6;3(1):e284.

Demling RH, DeSanti L. Management of partial thickness facial burns (comparison of topical antibiotics and bio-engineered skin substitutes). Burns. 1999 May;25(3):256-61.

Department Of Health & Human Services. Centers for Medicare & Medicaid Services (CMS) Healthcare Common Procedure Coding System (HCPCS) Application Summaries and Coding Recommendations. Second Quarter, 2024 HCPCS Coding Cycle. Available at: https://www.cms.gov/Medicare/Coding/HCPCSReleaseCodeSets/HCPCS-Quarterly-Update. Accessed August 26, 2024.

~~Department Of Health & Human Services. Centers for Medicare & Medicaid Services (CMS) Healthcare Common Procedure Coding System (HCPCS) Application Summaries and Coding Recommendations. Third Quarter 2023. Available at: https://www.cms.gov/Medicare/Coding/HCPCSReleaseCodeSets/HCPCS-Quarterly-Update. Accessed December 7, 2023.~~

Dhanraj P. A Clinical Study Comparing Helicoll with Scarlet Red and OpSite in the treatment of split thickness skin graft donor sites-a randomized controlled trial. Indian J Surg. 2015 Dec;77(Suppl 2):385-92.

Dorweiler B, Trinh TT, Dünschede F, et al. The marine Omega3 wound matrix for treatment of complicated wounds: A multicenter experience report. Gefasschirurgie. 2018;23(Suppl 2):46-55.

ECRI Institute. Clinical Evidence Assessment. AmnioBand Allograft Placental Matrix (MTF Biologics) for treating chronic wounds. Plymouth Meeting, PA. September 2020.

ECRI Institute. Clinical Evidence Assessment. Biovance Amniotic Membrane Allograft (Cellularity, Inc.) for treating chronic wounds. Plymouth Meeting (PA). July 2020.

ECRI Institute. Clinical Evidence Assessment. Grafix Cellular Repair Matrix (Osiris Therapeutics, Inc.) for treating chronic wounds Plymouth Meeting (PA): ECRI; July 2021.

ECRI Institute. Clinical Evidence Assessment. Matriderm Acellular Dermal Matrix (MedSkin Solutions) for treating burns. 2023 Apr.

ECRI Institute. Clinical Evidence Assessment. MatriDerm (MedSkin Solutions) for Managing Wounds following Otorhinolaryngology Surgery. Plymouth Meeting (PA): ECRI; 2022 Apr.

ECRI Institute. Clinical Evidence Assessment. Neox Flo Wound Matrix (Amniox Medical, Inc.) for treating chronic wounds. Plymouth Meeting, PA. August 2021.

ECRI. Clinical Evidence Assessment. Restrata Resorbable Wound Matrix (Acera Surgical) for treating acute and surgical wounds. 2024 Mar.

ECRI. Clinical Evidence Assessment. Restrata Resorbable Wound Matrix (Acera Surgical) for treating complex and chronic wounds. 2024 Mar.

ECRI Institute. Clinical Evidence Assessment. Suprathel Skin Substitute (PolyMedics Innovations GmbH) for treating donor site wounds. February 2021.

ECRI Institute. Clinical Evidence Assessment. Suprathel Skin Substitute (PolyMedics Innovations GmbH) for treating burns. April 2023.

ECRI Institute. Product Brief. AmnioExcel Amniotic Allograft Membrane (Integra LifeSciences Corp.) for treating chronic wounds. November 2019.

ECRI Institute. Product Brief. AmnioFix Amnion/Chorion Membrane Allograft (MiMedx) for treating surgical wounds. May 2019.

ECRI Institute. Product Brief. Arthroflex Acellular Dermal Matrix (LifeNet Health and Arthrex, Inc.) for repairing large to massiverRotator cuff tears. October 2017;Updated June 2022.

ECRI Institute. Product Brief. Biovance Amniotic Membrane Allograft (Celularity, Inc.) for treating chronic wounds. Plymouth Meeting (PA): July 2020.

ECRI Institute. Product Brief. Cytal Burn Matrix (ACell, Inc.) for Treating Acute and Chronic Wounds. September 2018.

ECRI Institute. Product Brief. Cytal Wound Matrix (ACell, Inc.) for treating acute and chronic wounds. March 2019.

ECRI Institute. Product Brief. Dermacell AWM (LifeNet Health Bio-Implants Division) for chronic wounds care. December 2020.

ECRI Institute. Product Brief. EpiFix Amnion/Chorion Membrane Allograft (MiMedx) for treating chronic wounds. December 2019.

ECRI Institute. Product Brief. Hyalomatrix Tissue Reconstruction Matrix (Anika Therapeutics, Inc.) for treating burns. May 2018.

ECRI Institute. Product Brief. Hyalomatrix Tissue Reconstruction Matrix (Anika Therapeutics, Inc.) for treating chronic wounds. April 2021.

ECRI Institute. Product Brief. Miroderm Acellular Wound Matrix (Miromatrix Medical, Inc.) for treating chronic wounds. September 2018.

ECRI Institute. Product Brief. Omega3 Wound Matrix (Kerecis) for treating acute wounds. April 2020.

ECRI Institute. Product Brief. Omega3 Wound Matrix (Kerecis) for Treating Chronic Wounds. June 2019; Updated May 2023.

ECRI Institute. Product Brief. PriMatrix Dermal Repair Scaffold (Integra LifeSciences Corp.) for treating chronic wounds. October 2019.

ECRI Institute. Product Brief. PuraPly Wound Matrices (Organogenesis, Inc.) for treating acute and chronic wounds. November 2018; Updated April 2022.

ECRI Institute. Product Brief. SkinTE (PolarityTE, Inc.) for treating acute and chronic wounds. August 2018.

ECRI Institute. Clinical Evidence Assessment. Theragenesis bilayer wound matrix for treating partial-and full-thickness wounds. Plymouth Meeting, PA. February 2023.

ECRI Institute. Product Brief. TheraSkin Human Skin Allograft (Solsys Medical, LLC) for treating surgical and chronic wounds. October 2018; Updated April 2019.

Farivar BS, Toursavadkohi S, Monahan TS, et al. Prospective study of cryopreserved placental tissue wound matrix in the management of chronic venous leg ulcers. J Vasc Surg Venous Lymphat Disord. 2019 Mar;7(2):228-233.

Ferreira M.C., Paggiaro A.O., Isaac C., et al., dos Santos G.B. Skin substitutes: current concepts and a new classification system. Rev. Bras. Cir. Plást. 2011;26:696–702.

Gómez R, Cancio LC. Management of burn wounds in the emergency department. Emerg Med Clin North Am. 2007 Feb;25(1):135-46.

Gould L, Stuntz M, Giovannelli M, et al. Wound Healing Society 2015 update on guidelines for pressure ulcers. Wound Repair Regen. 2016 Jan-Feb;24(1):145-62.

Hayes Inc. Comparative Effectiveness Review. Acellular skin Substitutes for chronic foot Ulcers in adults with diabetes mellitus. Lansdale, PA: Hayes. May 2020, Updated May 2023.

Hayes Inc. Comparative Effectiveness Review. Cellular skin substitutes for chronic foot ulcers in adults with diabetes mellitus. Lansdale, PA: Hayes. March 2020, Updated April 2023.

Hayes Inc. Evidence Analysis Research Brief. PuraPly AM antimicrobial wound matrix (organogenesis) for treatment of wounds. Lansdale, PA: Hayes. March 2022.

Hayes, Inc. Evolving Evidence Review. Kerecis omega3 wound (kerecis) fish skin grafts for management of burns. Lansdale, PA: Hayes. February 2024. Lansdale, PA: Hayes. February 2024.

Hayes Inc. Evolving Evidence Review. Kerecis Omega3 Wound for the management of chronic lower extremity wounds. Lansdale, Pa: Hayes. February 2022.

Hayes Inc. Health Technology Assessment. Grafix Cryopreserved Placental Membrane (Osiris Technologies Inc.) for treatment of chronic foot ulcers in patients with diabetes mellitus. Lansdale, PA: Hayes. September 2019, updated October 2022.

Hayes Inc. Health Technology Assessment. Human Amniotic Membrane Injections for Treatment of Chronic Plantar Fascitis. Lansdale, Pa: November 2019; Updated December 2021.

Hayes Inc. Health Technology Assessment. Skin substitutes for venous leg ulcers in adults. Lansdale, PA: Hayes. July 2020, updated ~~September 2021~~**July 2023**.

Hundeshagen G, Collins VN, Wurzer P,et al. A prospective, randomized, controlled trial comparing the outpatient treatment of pediatric and adult partial-thickness burns with Suprathel or Mepilex Ag. J Burn Care Res. 2018 Feb 20;39(2):261-267.

Huntington CR, Cox TC, Blair LJ, et al. Biologic mesh in ventral hernia repair: Outcomes, recurrence, and charge analysis. Surgery. 2016 Dec; 160(6):1517-1527.

Jakob MO, Haltmeier T, Candinas D, et al. Biologic mesh implantation is associated with serious abdominal wall complications in patients undergoing emergency abdominal surgery - a randomized-controlled clinical trial. J Trauma Acute Care Surg. 2020 Jul 8.

Johnson EL, Marshall JT, Michael GM. A comparative outcomes analysis evaluating clinical effectiveness in two different human placental membrane products for wound management. Wound Repair Regen. 2017 Jan;25(1):145-149.

Karlsson M, Lindgren M, Jarnhed-Andersson I, et al. Dressing the split-thickness skin graft donor site: a randomized clinical trial. Adv Skin Wound Care. 2014 Jan;27(1):20-5.

Kaufmann R, Isemer FE, Strey CW, et al. Non-cross-linked biological mesh in complex abdominal wall hernia: a cohort study. Langenbecks Arch Surg. 2020 May;405(3):345-352.

Kelechi TJ, Mueller M, Hankin CS, et al. A randomized, investigator-blinded, controlled pilot study to evaluate the safety and efficacy of a poly-N-acetyl glucosamine-derived membrane material in patients with venous leg ulcers. J Am Acad Dermatol. 2012 Jun;66(6):e209-15.

Kelley TM Jr, Kashem M, Wang H, et al. Anterior leaflet augmentation with cormatrix porcine extracellular matrix in twenty-five patients: unexpected patch failures and histologic analysis. Ann Thorac Surg. 2017 Jan;103(1):114-120.

Kimmel H, Gittleman H. Retrospective observational analysis of the use of an architecturally unique dermal regeneration template (Derma Pure®) for the treatment of hard-to-heal wounds. Int Wound J. 2017 Aug;14(4):666-672.

Kirsner RS, Margolis DJ, Baldursson BT, et al. Fish skin grafts compared to human amnion/chorion membrane allografts: A double-blind, prospective, randomized clinical trial of acute wound healing. Wound Repair Regen. 2020 Jan;28(1):75-80. doi: 10.1111/wrr.12761. Epub 2019 Oct 25. PMID: 31509319; PMCID: PMC6972637.

Kumar P, Gupta A. Updated classification of skin substitutes. Indian J Plast Surg. 2023 Jul 28;56(4):388-389.

Loan F, Cassidy S, Marsh C, et al. Keratin-based products for effective wound care management in superficial and partial thickness burns injuries. Burns. 2016; 42(3):541-547.

Markl P, Prantl L, Schreml S, et al. Management of split-thickness donor sites with synthetic wound dressings: results of a comparative clinical study. Ann Plast Surg. 2010 Nov;65(5):490-6.

Marston W, Tang J, Kirsner RS, et al. Wound Healing Society 2015 update on guidelines for venous ulcers. Wound Repair Regen. 2016 Jan-Feb;24(1):136-44.

Maxwell DW, Hart AM, Keifer OP Jr, et al. A comparison of acellular dermal matrices in abdominal wall reconstruction. Ann Plast Surg. 2019 Apr;82(4):435-440.

McNamara SA, Hirt PA, Weigelt MA, et al. Traditional and advanced therapeutic modalities for wounds in the paediatric population: an evidence-based review. J Wound Care. 2020 Jun 2;29(6):321-334.

Miranda EP, Friedman A. Dehydrated human amnion/chorion grafts may accelerate the healing of ulcers on free flaps in patients with venous insufficiency and/or lymphedema. Eplasty. 2016 Sep 7;16:e26.

Moravvej H, Hormozi AK, Hosseini SN, et al. Comparison of the application of allogeneic fibroblast and autologous mesh grafting with the conventional method in the treatment of third-degree burns. J Burn Care Res. 2016 Jan-Feb;37(1):e90-5.

Mosala Nezhad Z, Poncelet A, de Kerchove L, et al. Small intestinal submucosa extracellular matrix (CorMatrix®) in cardiovascular surgery: a systematic review. Interact Cardiovasc Thorac Surg. 2016 Jun;22(6):839-50.

National Cancer Institute (NCI) Dictionary of Cancer Terms. Available at: https://www.cancer.gov/publications/dictionaries/cancer-terms. Accessed July 22, 2024.

National Institute for Health and Care Excellence (NICE).Medtech Innovation Briefing. EpiFix for chronic wounds. London (UK): Published January 2018.

Nicholas MN, Jeschke MG, Amini-Nik S. Methodologies in creating skin substitutes. Cell Mol Life Sci. 2016 Sep;73(18):3453-72.

Noordenbos J, Doré C, Hansbrough JF. Safety and efficacy of TransCyte for the treatment of partial-thickness burns. J Burn Care Rehabil. 1999 Jul-Aug;20(4):275-81.

Ogaya-Pinies G, Palayapalam-Ganapathi H, Rogers T, et al. Can dehydrated human amnion/chorion membrane accelerate the return to potency after a nerve-sparing robotic-assisted radical prostatectomy? Propensity score-matched analysis. J Robot Surg. 2018 Jun;12(2):235-243.

Pham C, Greenwood J, Cleland H, et al. Bioengineered skin substitutes for the management of burns: a systematic review. Burns. 2007 Dec;33(8):946-57.

Regulski MJ, MacEwan MR. Implantable nanomedical scaffold facilitates healing of chronic lower extremity wounds. Wounds. 2018 Aug;30(8):E77-E80.

Sabolinski ML, Gibbons G. Comparative effectiveness of a bilayered living cellular construct and an acellular fetal bovine collagen dressing in the treatment of venous leg ulcers. J Comp Eff Res. 2018 May 29.

Schwarze H, Küntscher M, Uhlig C, et al. Suprathel, a new skin substitute, in the management of donor sites of split-thickness skin grafts: results of a clinical study. Burns. 2007 Nov;33(7):850-4.

Serena TE, Carter MJ, Le LT, et al; EpiFix VLU Study Group. A multicenter, randomized, controlled clinical trial evaluating the use of dehydrated human amnion/chorion membrane allografts and multilayer compression therapy vs. multilayer compression therapy alone in the treatment of venous leg ulcers. Wound Repair Regen. 2014 Nov-Dec;22(6):688-93.

Serena TE, Orgill DP, Armstrong DG, et al. A multicenter, randomized, controlled, clinical trial evaluating dehydrated human amniotic membrane in the treatment of venous leg ulcers. Plast Reconstr Surg. 2022 Nov 1;150(5):1128-1136.

Serena TE, Yaakov R, DiMarco D, et al. Dehydrated human amnion/chorion membrane treatment of venous leg ulcers: correlation between 4-week and 24-week outcomes. J Wound Care. 2015 Nov;24(11):530-4.

Simman R, Mari W, Younes S, Wilson M. Use of hyaluronic acid-based biological bilaminar matrix in wound bed preparation: a case series. Eplasty. 2018 Feb 22;18:e10. eCollection 2018.

Smiell JM, Treadwell T, Hahn HD, et al. Real-world experience with a decellularized dehydrated human amniotic membrane allograft. Wounds. 2015 Jun;27(6):158-69.

Snyder DL, Sullivan N, Margolis DJ, et al. Skin substitutes for treating chronic wounds. Technology Assessment Program Project ID No. WNDT0818. (Prepared by the ECRI Institute-Penn Medicine Evidence-based Practice Center under Contract No. HHSA 290-2015-00005-I) Rockville, MD: Agency for Healthcare Research and Quality. February 2020. Available at: https://www.ncbi.nlm.nih.gov/books/NBK554220/. Accessed **August 26, 2024** ~~September 27, 2023~~.

Tan M, Woo P. Injection laryngoplasty with micronized dermis: a 10-year experience with 381 injections in 344 patients. Laryngoscope. 2010Dec;120(12):2460-6.

Towler MA, Rush EW, Richardson MK, et al. Randomized, prospective, blinded-enrollment, head-to-head venous leg ulcer healing trial comparing living, bioengineered skin graft substitute (Apligraf) with living, cryopreserved, human skin allograft (TheraSkin). Clin Podiatr Med Surg. 2018 Jul;35(3):357-365.

Treadwell T, Sabolinski ML, Skornicki M, et al. Comparative effectiveness of a bioengineered living cellular construct and cryopreserved cadaveric skin allograft for the treatment of venous leg ulcers in a real-world setting. Adv Wound Care (New Rochelle). 2018 Mar 1;7(3):69-76.

Trippoli S, Caccese E, Tulli G, et al. Biological meshes for abdominal hernia: Lack of evidence-based recommendations for clinical use. Int J Surg. 2018 Mar 2; 52:278-284.

Tsikopoulos K, Vasiliadis HS, Mavridis D. Injection therapies for plantar fasciopathy ('plantar fasciitis'): a systematic review and network meta-analysis of 22 randomized controlled trials. Br J Sports Med. 2016 Nov;50(22):1367-1375.

Vana LPM, Battlehner CN, Ferreira MA, et al. Comparative long-term study between two dermal regeneration templates for the reconstruction of burn scar contractures in humans: Clinical and histological results. Burns. 2020 May;46(3):596-608.

Vig K, Chaudhari A, Tripathi S, et al. Advances in skin regeneration using tissue engineering. Int J Mol Sci. 2017 Apr 7;18(4).

Yang CK, Polanco TO, Lantis JC 2nd. A prospective, postmarket, compassionate clinical evaluation of a novel acellular fish-skin graft which contains Omega-3 Fatty Acids for the closure of hard-to-heal lower extremity chronic ulcers. wounds. 2016 Apr;28(4):112-8.

Zelen CM, Poka A, Andrews J. Prospective, randomized, blinded, comparative study of injectable micronized dehydrated amniotic/chorionic membrane allograft for plantar fasciitis--a feasibility study. Foot Ankle Int. 2013a;34(10):1332-1339.

Policy History/Revision Information

Date	Summary of Changes
TBD	**Coverage Rationale** • Revised list of skin and soft tissue substitutes that are unproven and not medically necessary for any indication; added: ○ AmnioPlast 1 ○ AmnioPlast 2 ○ Artacent C ○ Artacent Trident ○ Artacent Velos ○ Artacent Vericlen ○ Dermacyte AC Matrix Amniotic Membrane Allograft ○ MatriDerm ○ Matrix HD Allograft Dermis ○ MicroMatrix Flex ○ MiroTract Wound Matrix ○ SimpliGraft or SimpliMax ○ TheraMend ○ Tri-Membrane Wrap **Definitions** • Removed definition of: ○ Acellular Matrix ○ Allogeneic Matrix ○ Composite Matrix ○ Human Skin Allograft ○ Measurable Signs of Healing ○ Xenograft **Applicable Codes** • Added HCPCS codes A2027, A2028, A2029, Q4334, Q4335, Q4336, Q4337, Q4338, Q4339, Q4340, Q4341, Q4342, Q4343, Q4344, and Q4345 • Added notation to indicate HCPCS codes A2026, A2027, A2028, A2029, Q4311, Q4312, Q4313, Q4314, Q4315, Q4316, Q4317, Q4318, Q4319, Q4334, Q4335, Q4336, Q4337, Q4338, Q4339, Q4340, Q4341, Q4342, Q4343, Q4344, and Q4345 are not on the State of Louisiana Medicaid Fee Schedule and therefore may not be covered by the State of Louisiana Medicaid Program **Supporting Information** • Updated *Description of Services*, *Clinical Evidence*, and *References* sections to reflect the most current information • Archived previous policy version CS153LA.P

Instructions for Use

This Medical Policy provides assistance in interpreting UnitedHealthcare standard benefit plans. When deciding coverage, the federal, state or contractual requirements for benefit plan coverage must be referenced as the terms of the federal, state or contractual requirements for benefit plan coverage may differ from the standard benefit plan. In the event of a conflict, the federal, state or contractual requirements for benefit plan coverage govern. Before using this policy, please check the federal, state or contractual requirements for benefit plan coverage. UnitedHealthcare reserves the right to modify its Policies and Guidelines as necessary. This Medical Policy is provided for informational purposes. It does not constitute medical advice.

UnitedHealthcare may also use tools developed by third parties, such as the InterQual® criteria, to assist us in administering health benefits. The UnitedHealthcare Medical Policies are intended to be used in connection with the independent professional medical judgment of a qualified health care provider and do not constitute the practice of medicine or medical advice.