FISH SKIN GRAFT TO HEAL OVER AVASCULAR STRUCTURES

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1:KOL for Kerecis

Background

Fish skin grafts (FSG) are increasingly being used for a wide range of wound repair. It's versatility is attributed to the fish skin's protein composition which closely resembles that of human skin, allowing for the graft to be used in a homologous manner to treat human skin. The graft's porous microstructure provides for efficient ingrowth of dermal cells and capillaries, further supporting the body's own ability to regenerate by recruiting the body's own cells [1]

Human and farm animal tissue require extensive processing and treatment with the harsh chemicals which dissolve components of the native tissues; this reduces it to a matrix of inactive collagen connective tissue only. Pathogen transmission risk from the Icelandic cod (Gadus morhua) to humans is nonexistent. This allows for minimal processing of the fish skin, preserving its native structure and chemical components. Specifically, it includes Omega-3 fatty acids, which are not found in mammalian products. Omega-3's are highly effective as antimicrobial agents and in modulating the inflammatory response of the acute wound healing stage [2]

Previous studies have shown that the fish skin grafts mediate significantly faster healing compared to porcine or amniotic/ chorionic products [3,4] . Additionally, previous studies also show relatively short average time until complete healing and analgesic effects (attributed to the Omega-3 fatty acids) [5]. The objective of this case series is to display FSG's powerful angiogenic ability by providing evidence of its healing over avascular structures.

Methods

Wounds were prepared as necessary and FSG was applied. Deeper wounds had graft applied in multiple layers. The incorporating graft islands and peripheral wound edges were fenestrated at follow up visits, for saturation of blood to allow for further incorporation of graft. Of note, applying the graft in layers and fenestrating the wound post-operatively contrasts directly with post-operative protocols of other grafts. Additional grafting was performed as needed.

Case Study 1

68 y/o female w/ PMHx of HTN, RA, controlled DM2 and social history of smoking c/o R. Bunion pain and 2nd/3rd toe pain. States she had a bunionectomy and other procedures performed in the 90s after which her pathologies returned. She had a first MPJ arthrodesis performed as well as lesser 2nd/3rd MPJ capsular releases with hammertoe procedures.

One week post-operatively, patient followed up with an infected necrotic incisional wound which was deep to bone with exposed hardware. Patient was immediately taken for and I&D and external fixator application, and FSG was applied once the infection was cleared.

Pre-operative

Post-operative

s/p 1 week

s/p I&D and ex-fix application

First Application of FSG

s/p 1 week application #1

s/p 2 weeks #1, application #2 today

s/p 1 week application #2

s/p 2 weeks application #2, application #3 today

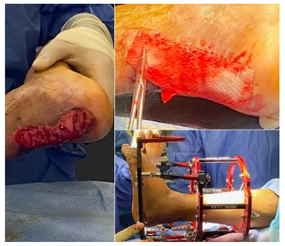
s/p 1 week application #3

s/p 2 weeks #3, application #4 today

s/p 1 week application #4, 52 days after initial application

Case Study 2

48 y/o paraplegic male with PMHx of DM2 and PAD presented with a pressure wound with Achilles tendon explored. Grafting was performed and an external fixator was applied to offload the wound.



Application #1

s/p 4 weeks application#1, ex fix removed today

s/p 5 weeks application #1

Case Study 3

40 y/o male w/ PMHx of DM2 and smoking history had a traumatic degloving injury which resulted in deep wound to the forefoot with explored tendons. For this patient, Medical honey was applied over the FSG.

Of note, this patient was a Charity care case, therefore as minimal as possible intervention had to be performed due to the financial constraints.

Application #1

s/p 1 week, application #1

s/p 2 weeks, application #1

s/p 5 weeks application #1, application #2 today

s/p 2 weeks application #2

s/p 4 weeks application #2

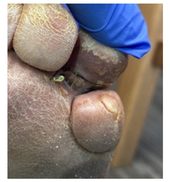
s/p 6 weeks application #2

s/p 9 weeks application #2

Case Study 4

83 y/p F w/ PMHx of DM2 with neuropathy, HTN, CAD reports with a left sub 4th toe wound with tendon exposed for an unknown duration. Due to the age of the patient, her family was pushing for a toe amputation due to the possible inconveniences of the wound healing process.

Application#1



s/p 2 weeks, application#1

s/p 3 weeks, application#1

s/p 4 weeks, application#1

Results

As evidenced in the clinical photographs, in all cases after only a single application of the graft there is significant granulation tissue over both exposed tendon and bone, without the assistance of NPWT. Additionally, as the wounds healed into healthy skin one notes an initial purplish hue of the new forming skin, very similar in appearance to a healing Split Thickness Skin Graft. All wounds resulted in healthy, elastic skin formed in accordance with the Langer lines.

Conclusion

FSG's capacity to heal over avascular structures without the need for NPWT makes it a promising treatment for wounds with exposed tendons or bone. Observing how similar the graft healing process is that to a STSG, due to the graft's homologous structure to human skin, proves the FSG to be a viable alternative to a STSG. Further investigation of FSG's versatility is warranted to provide more evidence of its effectiveness and wide applicability.

References

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