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The Adjunctive Use of Biologically Engineered Products in Plastic Surgery Practice

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Abstract Biologically engineered products are medical devices offer support and structure for wound healing by providing a scaffold for cell growth and proliferation. In the field of plastic surgery, these devices are being used to improve the outcomes of surgical closure in selected patients. The purpose of this article is to provide an overview of the source, indications, mechanisms, and outcomes of commonly used biologic products in wound healing. It will also provide an understanding of how biologics can be of value to patients with significant tissue defects requiring plastic surgery.

Introduction

There has been an explosion of biologic tissue devices recently. The promise of regenerative medicine with improved healing and faster return to normal function has led to a demand for these products. The demand is primarily driven by health care providers seeking improved outcomes for patients with challenging clinical problems, along with extensive commercial marketing efforts. Most of these products have significant basic science research touting potential clinical benefits. However, high quality randomized clinical trials are lacking for these products. In addition, the cost of these products can significantly impact the financial viability of wound care programs. Physicians and health systems are becoming responsible for the cost of care provided. The purpose of this article is to describe the use of selected biologic products the senior author (R.M.J.) has used as an adjunct to plastic surgery procedures. An introduction to value analysis of biologic products will be also covered.

Methods

Representative plastic surgery case studies utilizing commercially available biologic regenerative medicine products are presented. The authors have no financial relationship to the manufacturers of these products. A background of the mechanism of biologic activity, and approved FDA indications are reported. The senior author's experience with key clinical tips are provided. A primer on value analysis of biologic products is also given.

Case Study 1

A 44 year old female involved in a motorcycle crash suffering a 4th degree road rash injury to the right foot presents with two areas of exposed bone approximately 2 by 2 cm, and the entire wound approximately 15 by 10 cm. Following thorough debridement, the areas of exposed bone were covered with porcine UBM powder and a wound matrix sheet. A wound Vac® was placed over the sheet and two weeks later, a small local flap and skin graft were

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performed. Complete healing occurred in approximately 6 weeks without the need for free flap reconstruction Fig. 1.

Acellular Porcine Urinary Bladder

The acellular UBM is a xenograft, derived from porcine urinary bladder and acts as a basement membrane scaffold.[1] This product matrix is commercially available as ACell® in both a powder and sheet format. The powder formulation permits distribution throughout the wound due to the powder formulation, and in its low production cost. FDA approved indications include partial and full thickness wounds, second degree burns, pressure ulcers, venous ulcers, diabetic ulcers, tunneling wounds, surgical wounds such as graft donor sites and post Mohs surgical sites, post laser, wound dehiscence, abrasion, laceration, and draining wounds.[2] Anecdotally experience has shown improvement in ulcers related to radiation burns.

Key Clinical Tips

Acellular UBM is useful to convert small areas of non-graftable exposed bone into an appropriate wound bed for skin grafting. This can prevent the need for more extensive and costly microsurgical distant tissue transfers.

Case Study 2

A 53 year old male involved in a motor vehicle crash suffered a grade 3 B open fracture to the right leg with extensive de-gloving injury. The patient underwent broad debridement, and a free latissimus dorsi muscle flap with autograft on post trauma day 5. The flap and graft did well but there was further demarcation of the skin on the opposite side of the foot. Local debridement helped to promote granulation tissue development leaving approximately 80 cm^2 of remaining open wound. The patient did not desire an additional skin graft, therefore, the option of a skin substitute was given. Oasis® was used as a keratinocyte scaffold to promote re-epithelialization. Successful healing occurred after 5 applications without a return trip to the operating room Fig. 2.

Porcine Small Intestine Submucosa

Commercially available as OASIS® wound matrix, the product is derived from the submucosa layer of the porcine small intestine. The submucosa layer provides much of the strength and flexibility to the small intestine and these properties provide unique aspects to this form of graft.[1] OASIS®

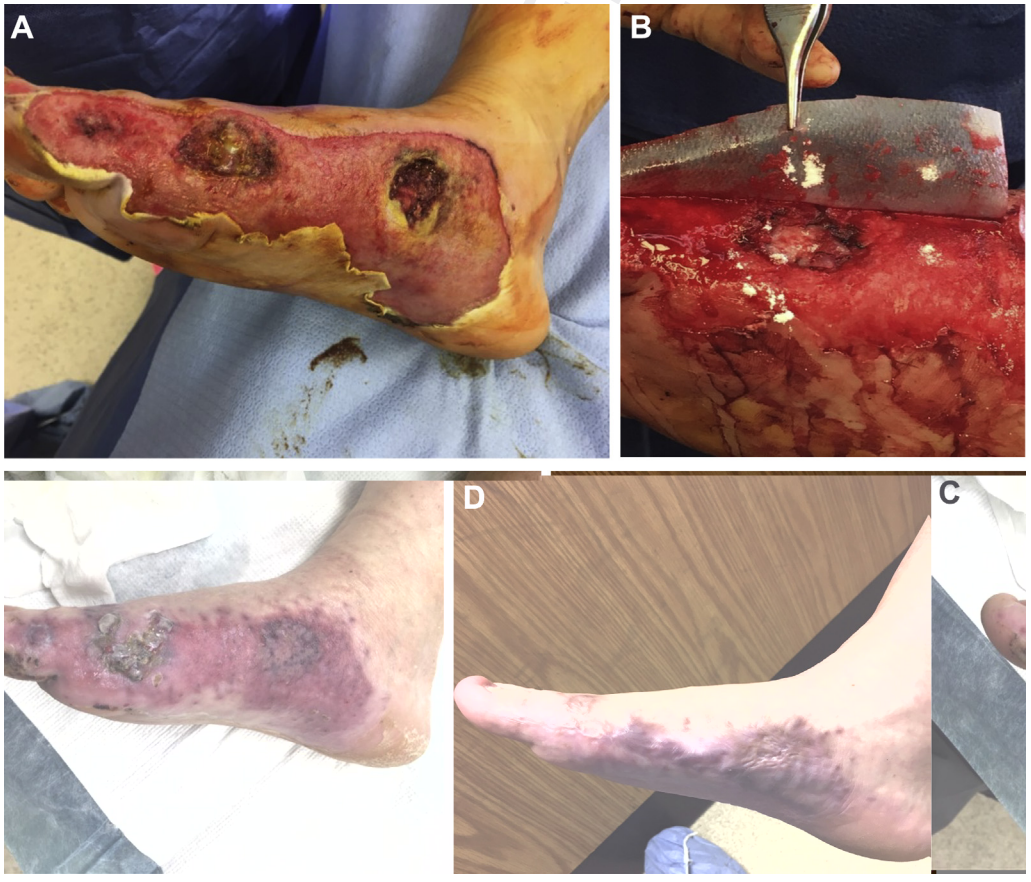

Figure 1 Case 1 figure A- Motor vehicle crash with exposed bone two areas, B reconstruction of radial collateral ligament of 1st metatarsal with UBM sheet and coverage with UBM micromatrix. And sheet, C wound closure after autograft and local flap, D- final closure 6 months post injury scar still improving.