RFP Journal of ENT and Allied Sciences
Volume 6 Number 2, July-December 2021

Biological Scaffolds: A Review

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How to cite this article:
Sowmya Ramgopal, Ravi Kumar Chittoria, Neljo Thomas / Biological Scaffolds: A Review / RFP J ENT Allied Sci 2021;6(2):47–49.

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Received on: 09.06.2022

Accepted on: 19.06.2022

Abstract

Biological scaffolds have been used in various fields to augment tissue repair and regeneration. It is of various types and have been of its own advantages and disadvantages. In this article we discuss about the biological scaffolds and its applications.

Keywords: Biological Scaffolds; Breast Surgery; Abdominal Surgery.

Introduction

Biological scaffold is defined as a biomaterial structure that serves as a substrate and guide for tissue repair and regeneration. With advancements in biological scaffolds have become an important tenet to regenerative medicine inplastic surgery. Not only do biological scaffolds provide a structural support but they also, through their inherent properties promote cellular proliferation and differentiation. Biological scaffolds are aligned with our broader objective of making interventions as biocompatible as possible.

History

Since its emergence in the mid-1980s, tissue engineering has continued to evolve as an exciting and multidisciplinary field aiming to develop biological substitutes to restore, replace or regenerate defective tissues. Cells, scaffolds and growth stimulating signals are generally referred to as the tissue engineering triad, the key components of engineered tissues.

Mechanism of Action

By virtue of their inherent mechanical, biological and architectural properties biological scaffolds assist in tissue engineering and regeneration by:

1. Providing a support matching the original extracellular material in terms of its mechanical properties.
2. Promote specific cellular lineage regeneration and differentiation by using the principle of durotaxis.
3. Scaffolds can, for example, be engineered to contain adhesion ligands establishing topography and promote correct cell

deposition and alignment, or biological cues such as growth factors, nucleic acids, and cytokines that promote tissue proliferation

Advantages of Biological Scaffolds in Tissue Engineering –

a. In Skin Repair

Scaffolds are effective when they inhibit wound contraction and its sequelae, scar formation, and their effectiveness can be modified by varying their pore structure, degradation rate, and surface biochemistry.

Hence , they have been used in the treatment of partial and full thickness wounds, pressure ulcers, diabetic foot ulcers, chronic vascular ulcers, surgical wounds, venous lower extremity ulcers, and burns.

b. In Breast Surgery

Acellular dermal matrix improves surgical and aesthetic outcomes by providing tissue support to the mastectomy skin flaps. It can minimize periprosthetic fibrosis and appears to lessen the inflammatory response associated with prosthetic devices.[7] Use of acellular dermal matrix in the setting of radiation therapy is useful in the short-term but may not ameliorate soft tissue related morbidities in the long term.

c. In Abdominal Surgeries

The use of biological meshes in the repair of hernias is a matter of debate, which can be summarised by the following table.

Disadvantages

PROS	CONS
Carries lower isk of infection.	Biological meses are expensive
Can be used in the management of Parastomal Hernia[2]	Recurrence rates are relatively more[8]
Can be used in the management of Hiatal Hernias.	Long term results are not favourable as increased rates of abdominal wall laxity[8]

1. Standardization for the safety assessment ofthe cell–scaffold construct is very difficult.
2. Maintaining neovascularisation in the in vitro setting is a challenge.. It is virtuallyimpossible to expect the neovascularization through out a cell–scaffold construct in the case of in vitrotissueengineering.
3. Ethical Issues – The main source of the biological scaffolds is from the connective tissue of lower mammals.

Complications

These biologic materials are typically allogeneic or xenogeneic in origin and are derived from tissues such as small intestine, urinary bladder, dermis, and pericardium of lower mammals.

The innate and acquired host immune response to these biological scafoolds has been largely unexplored.

References

1. Jin J, Rosen MJ, Blatnik J, McGee MF, Williams CP, Marks J, Ponsky J. Use of acellular dermal matrix for complicated ventral hernia repair: does technique affect outcomes? J Am Coll Surg. 2007 Nov;205(5):654-60.
2. Lo Menzo E, Martinez JM, Spector SA, Iglesias A, Degennaro V, Cappellani A. Use of biologic mesh for a complicated paracolostomy hernia. Am J Surg. 2008 Nov;196(5):715-9.
3. Oelschlager BK, Pellegrini CA, Hunter J, Soper N, Brunt M, Sheppard B, Jobe B, Polissar N, Mitsumori L, Nelson J, Swanstrom L. Biologic prosthesis reduces recurrence after laparoscopic paraesophageal hernia repair: a multicenter, prospective, randomized trial. Ann Surg. 2006 Oct;244(4):481-90.
4. Harth KC, Rosen MJ. Major complications associated with xenograft biologic mesh implantation in abdominal wall reconstruction. Surg Innov. 2009 Dec;16(4):324-9.
5. Spear SL, Parikh PM, Reisin E, Menon NG. Acellular dermis assisted breast reconstruction. Aesthetic Plast Surg. 2008;32: 418-425.
6. Salzberg AC. Nonexpansive immediate breast reconstruction using human acellular tissue matrix graft (AlloDerm). Ann Plast Surg. 2006;57:1–5.
7. Basu CB, Leong M, Hicks MJ. Acellular cadaveric dermis decreases the inflammatory response in