Sophisticated graft materials and barrier membranes for oral surgery and implantology

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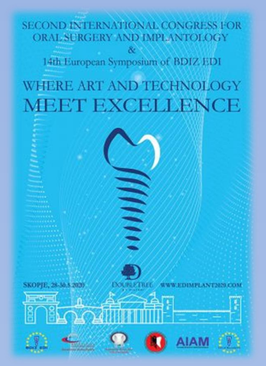

INTRODUCTION

Regarding to the need of bone graft materials and barrier membranes applications, it is known that bone loss and jawbone defects from different etiology are common, so their usage and features are increasingly being examined and analyzed. On the other hand, the different barrier membranes have a role to protect and stabilize graft material and to enable better regeneration.

AIM The main aim of this review article is to evaluate the data bases presenting the newest types of bone graft materials and barrier membranes applications and the benefits from their usage.

CLASSIFICATION OF BONE GRAFTING MATERIALS			
Autogenous bone Bone from the same individual	Allogeneic bone Bone from the same species but another individual	Xenogeneic bone Material of biologic origin but from another species	Alloplast Material of synthetic origin
Block graft	Free frozen bone	Material derived from animal bones	Calcium phosphates
Bone mill Bone scraper Suction device Piezoelectric surgery	Freeze-dried bone allograft	Material derived from corals	Glass-ceramics
	Demineralized freeze-dried bone allograft	Material derived from calcifying algae	Polymers
	Deproteinized bone allograft	Material derived from wood	Metals

Tab.1 Classification of bone grafting materials

Type	Commercial name (manufacturer)
Non-resorbable membranes	GORE-TEX (W. L. Gore)
	GORE-TEX-TI (W. L. Gore)
	High-density GORE-TEX (W. L. Gore)
	Cytoplast (Osteogenics)
	TefGen-FD (Lifecore Biomedical)
	Nonresorbable ACE (ACE Surgical Supply)
	Titanium Augmentation Micro Mesh (ACE Surgical Supply)
	Tocksystem Mesh (Tocksystem)
	Frios BoneShields (Dentsply Friadent)
	M-TAM (Stryker Leibinger)
Synthetic resorbable membranes	OsseoQuest (W. L. Gore)
	Biofix (Bioscience)
	Vicryl (Ethicon)
	Atrisorb (Tolmar)
	EpiGuide (Kensey Nash)
	Resolut (W. L. Gore)
	VIVOSORB (Polyganics)
Natural biodegradable materials	Endoret (BTI Biotechnology); platelet-rich fibrin (PRF process)
	Bio-Gide (Geistlich)
	BioMend (Zimmer Biomet)
	BioSorb membrane (3M ESPE)
	Neomem (Citagenix)
	OsseoGuard (BIOMET 3i)
	OSSIX (OraPharma)

Tab. 2 Classification of barrier membranes

MATERIAL AND METHOD

This survey is based on Narrative review on published articles reporting results related to the clinical applications of the newest bone graft materials and barrier membranes. The survey was conducted in the period from January 2020 to April 2020. The wide research was made using PubMed, Medscape, WebMD, including case reports, clinical studies, systematic reviews. All articles were screened, while the studies that met the criteria were selected for full text review.

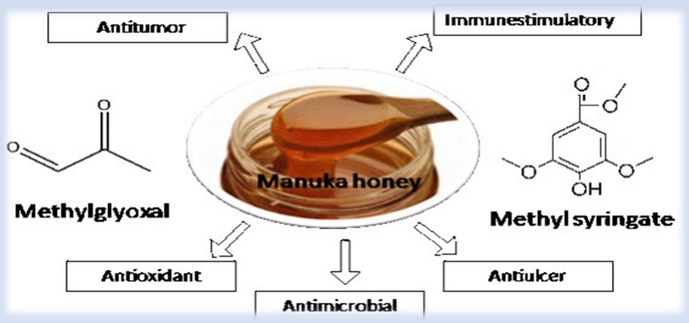

Fig.4 Effects of Manuka Honey

Fig.1 The ideal barrier membrane for GBR procedures needs to fulfill the following criteria: biocompatibility, space-making ability, cell occlusivity to prevent epithelial tissue downgrowth, ideal mechanical strength, and optimal degradation properties.

Fig.2 Type 1 crosslinked bovine collagen membrane (Mem-Lok) utilized to cover a lateral window during a sinus augmentation procedure.

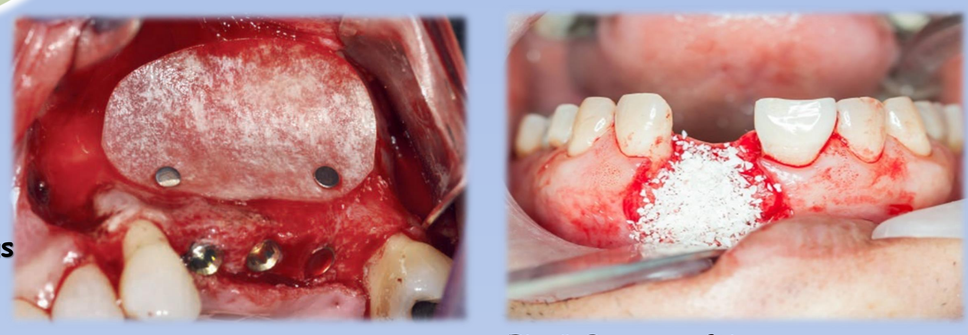

Fig.3 Bone grafting

DISCUSSION

Extensive research has been accomplished in the field of bone regenerative materials to improve their characteristics such as mechanical strength, molecular composition, biocompatibility, and degradation capacity in order to resemble features of natural bone.

Data from the FDA has shown that allografts are so far the most used bone grafts available on the market. Only 15% of augmentation procedures utilize autogenous bone, despite it being the gold standard for bone grafting. A new alternative bone-substitute, octacalcium phosphate, that provides the basis of the mineral crystals that generate bone, is combined with collagen (OCP/Col) and it has bone regenerative properties superior to the earlier substitutes.

The next generation of hydrogel systems could greatly improve current biomaterials to repair bone defects.

The local HA can be synthesized from gypsum powder using hydrothermal reaction, and its microstructure and functional groups did not change by the addition of extract from sea cucumber *S. hermanni* collagen. The investigated biocomposite material is nontoxic and biocompatible

Collagen membranes show improved biological and clinical features compared to both non-resorbable and other resorbable membranes, but they are not free from possible complications. Only the deep knowledge of the features of these biomaterials and the relative surgical procedures may allow clinicians to perform the right choice, in order to maximize the success rate of their clinical treatments.

Advantageous and future developments, such as Manuka honey incorporated membranes and those containing pro-healing and anti-inflammatory substances for wound healing and infection prevention, may be the driving factor motivating surgeons to practice ridge preservation into their post-extraction routines.

CONCLUSION

Advances in technology and sophisticated materials for bone grafting offer numerous solutions and different treatment options for patients with bone deficiency. The new way of solving large bone defects has been proved as far more successful in cases treated with a bone graft materials combined with a barrier membranes. Ongoing research is presently investigating the use of regenerative materials with a variety of additional regenerative agents, such as growth factors, antibacterial agents and other substances, that prove the benefits and the positive characteristics of their usage.