Bone Grafting as a Method to Regenerate Jaw Defects Present and Future

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Introduction

Bone grafting materials have been a documented, widely used method to regenerate bone defects due to periodontal disease, trauma and congenital deformities in the maxillofacial region. Various bone substitutes have already been applied in clinical practice, nevertheless none of them can be characterized ideal; non-toxic, consistently inducing bone formation, supplied in large quantities, readily available, easy to use and affordable [1] . Bone grafting materials, exhibit several properties including:

a) Osteoconduction: The biologic property of the grafted material to serve as a scaffold, allowing ingrowth of revascularization and viable new bone.

b) Osteoinduction: The ability of the bone substitute to induce differentiation of the host stem cells into osteoblasts.

c) Osteopromotion: Enhancement of osteoinductive properties of a second material, without the former being able to promote osteoinduction alone.

d) Finally, osteogenesis: the potential of bone production by presence of live osteoblasts within the graft [2].

Available bone substitutes are generally classified to the following categories:

Autografts

Autografts are considered the gold standard material since they possess osteoinductive, osteoconductive properties, while they exclusively contain vital osteoprogenitor cells. Also they are fully resorbable, completely histocompatible and inexpensive. Drawbacks related with autografting include donor site morbidity and limited amount of harvested material. In the maxillofacial area bone can be harvested from mandibular symphysis, the anterior region of mandibular ramus and maxillary tuberosity, each of them offering different amounts and type (cortical – cancellous) of bone.

Allograft

Allograft is bone grafts received from one individual to another of the same species. They are usually collected from tissue bank cadavers and further subdivided to fresh frozen, freeze dried and demineralised freeze dried bone allograft (exhibiting different antigenic and biomechanical properties).

Xenografts

These grafting materials are obtained from a species other than human, such as bovine, porcine or coral based bone.

Synthetic grafts

Synthetic bone chemically created, can be made from controlled manufacturing processes, resulting exceptionally reproducible properties.

Stem-cell based grafts

Stem cells are cultured in various additives such as dexamethasone, ascorbic acid and beta glycerol phosphates, in order to differentiate towards osteoblast lineage.

Growth factors enriched grafts

Specific growth factors enrichment of grafted materials can influence stem cell differentiation to osteoblast as well as control production and resorption of bone. Due to limitations and individual drawbacks of each grafting material, intense research efforts are being made, further seeking new promising substitutes that facilitate faster and denser bone regeneration [3].

References

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