



Tooth as Autogenous Bone Graft

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ABSTRACT

Dento alveolar bone resorption is a common phenomenon that occurs due to various reasons like early loss of teeth, aging, caries and periodontal diseases. Bone regeneration is a primary requisite for the therapeutic success in the management of periodontal diseases and preservation of alveolar socket preservation. Though there are many bone substitutes like xenograft, allograft, autogenous bone is considered to be the gold standard bone graft due to its osteoconductivity, osteoinductivity, and osteogenicity. The possibility of using tooth as an autogenous bone graft is explored in this review.

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INTRODUCTION

Dento alveolar bone resorption is a common phenomenon that can occur due to aging, tooth loss, prolong denture wear or a result of systemic conditions (1,2). A minimum amount of bone density is required for the replacement of the teeth by fabrication of the prosthesis or the use of implants. Bone deficient areas are built up with different materials, such as autografts, allografts, alloplasts and xenografts. Materials for bone grafts have been evolving rapidly over time (3). It is even more apt as the recent Meta-

analysis concluded that there is no evidence to show that autologous bone is superior to bone substitute materials in alveolar augmentation for implant surgery (4,5). Different materials such as bioactive glasses, glass ceramics, bioceramics, synthetic and natural polymers and composites have been studied and analysed for bone substitution procedures (6).

A biomaterial intended to repair hard tissue should be biocompatible, bioactive, osseoconductive preferably bio resorbable and its strength and elasticity should match those of the tissue to be substituted (7). Nowadays, various bone graft materials are developed due to advanced biograft material development technologies; as a result,

dento alveolar surgery can handle difficult osseous defects with various methods in the placement of implant, periodontal surgery, and maxillofacial surgery (8). The auto tooth bone graft material is a system that treats patients by manufacturing bone graft material from their own extracted teeth. It was introduced by the Korean Tooth Bank, and has satisfied many clinicians and patients for its osteoconduction as well as osteoinduction capacity. Auto Tooth bone graft material consists of inorganic (55%) and organic substances (45%). Among the inorganic substances, hydroxyapatite crystals has the characteristics of combining and dissociating phosphate and calcium as those of bone. Certain organic substances such as bone morphogenetic protein (BMP) and proteins with osteoinduction capacity as well as type I collagen, which is the same as alveolar bone itself are present (9,10). Therefore, they have the same bone remodeling capacity with autogenous bone. Auto Tooth bone graft materials are divided into block and powder types. The block graft harvested has osteoinduction, capacity via blood wettability and has osteoconductive capacity via space maintaining and creeping substitution along with space maintaining abilities. It is remodeled by maintaining space during a specific period (11). The powder type is

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available in different sizes of particles, porosity between powders, and blood wettability, osteoconduction, osteoinduction, and creeping substitution abilities. With above data, tooth as autologous bone graft material is very useful in clinical situations because it supports excellent bone regeneration through osteoconduction and osteoinduction capacity and minimizes foreign body rejection as the graft used on the same patient (12-14). Bone healing capacity using tooth as bone substitute is based on the radiological, histological, and clinical results of implant placement, socket preservation, maxillary sinus augmentation, and ridge augmentation, combined with guided bone regeneration using powder graft or block type graft showing greater clinical success.

BONE AUTOGRAFTS

Autografts are harvested from a donor site in the same individual and transplanted to another site. Autografts are a source of osteogenic organic materials for grafts (15). Autografts used in several dental procedures like periodontal defect, during implant placement, socket preservation apart from that it can be used in oral and maxillofacial surgery for cleft palate, cyst cavities (16). The autogenous bone graft has 99.9% of success rate and is more advantageous than other grafts. The only disadvantage of autografts is that limited graft can be obtained (9).

The chemical compositions of dentin and bone are similar to one another (17). The alveolar bone has 61% inorganic content, 32% organic substances and water, whereas the dentin has 65% inorganic substances, 29% organic substances and water (18,19).

Based on inorganic part analysis autogenic tooth bone graft material consists of five biological inorganic phosphates (low crystalline hydroxyapatite and another metallic element phosphate minerals like TCP, amorphous inorganic phosphate, dicalcium phosphate dihydrate, octacalcium phosphate)(21,22). These metallic element phosphates act reciprocally and are capable of transforming the present bone once grafted (23). Demineralized dentin matrix (DDM) is another graft material that consists of Type I collagen, and varied growth factors as well as Bone Morphogenic Proteins(BMP), that induces bone and cartilage growth, and non-collagenous proteins like osteocalcin and osteonectin, that are involved in calcification(24). Dentin-specific proteins as well as protein, (phosphophoryn) and dentin sialoprotein have conjointly been the components of dentin matrix (25). It is acknowledged that the demineralization method does not denature the type I collagens, growth factors, and non-collagenous proteins in order that the DDM will

maintain osteoinductive-healing capacities (26,27). Demineralized dentin deep seated subcutaneously within the dorsal region of rats not solely induced infiltration of monocytes and development of foreign body big cells, but also induced chondrogenesis. Gelatin capsules containing seventy milligrams of demineralized human dentin particles that were implanted into the femoral muscles of nude mice induced a small formation of bone and cartilage (28). These studies indicate that dentin contains bone and cartilage-inducing factors that facilitate chondro osteogenesis and modify the calcification method (29).

Clinical reports

Kim et al reported DDM powder underwent gradual resorption and was replaced by newly formed bone with well vascularization. They reported that there have been no infections among 250 patients who received auto tooth bone grafts with GBR, sinus grafts, socket preservation and ridge augmentation (30). An immediate DDM graft was performed around a transplanted tooth and periodontal regeneration was observed. They recommended that the preserved autogenic DDM can be used as collagenic biomaterial with osteoinductive potency. Jeong et al reported thirty seven patients receiving sinus bone graft, ridge augmentation and GBR with powder showed least to no post-operative complications throughout 2-year follow up (31).

CONCLUSION

There is sufficient evidence to recommend the use of tooth as graft material. It has more advantage than other grafts as it is an autogenous graft and has no adverse effects.

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