TOOTH TRANSFORMER

THE OSTEOINDUCTIVE PROPERTIES OF DENTIN MAY DEPEND ON DIFFERENT ACID TREATMENT PROTOCOLS

REVIEW ARTICLE

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Tooth-derived bone graft material

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With successful extraction of growth factors and bone morphogenic proteins (BMPs) from mammalian teeth, many researchers have supported development of a bone substitute using tooth-derived substances. Some studies have also expanded the potential use of teeth as a carrier for growth factors and stem cells. A broad overview of the published findings with regard to tooth-derived regenerative tissue engineering technique is outlined. Considering more than 100 published papers, our team has developed the protocols and techniques for processing of bone graft material using extracted teeth. Based on current studies and studies that will be needed in the future, we can anticipate development of xenBlasts, homogeneous and xenogeneous tooth bone grafts, and dental restorative materials using extracted teeth.

Key words: Tooth, Dentin, Demineralized dentin matrix, Bone substitutes, Tissue engineering
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I. Introduction

Tooth is a composite structure consisting of inorganic components including the calcium phosphate lineage and organic components such as collagen. Tooth minerals consist of five biological calcium phosphates: hydroxyapatite, tricalcium phosphate (TCP), octacalcium phosphate (OCP), amorphous calcium phosphate (ACP), and dicalcium phosphate dehydrate. Interacting reciprocally, these calcium phosphates are capable of remodeling the existing bone when grafted. The apatite existing within the bone tissue is known to be in the form of ceramic/high-polymer nano-composites.

Teeth and bones share many similarities. Teeth, cartilages, nerves, and maxillofacial bones all embryologically originated in the neural crest, sharing identical origin[1-4]. Clinicians support the intramembranous bone formation pathway when intraoral bone grafting is achieved[5-8]. The chemical compositions of teeth, especially dentin and bones, are very similar. Enamel consists of 96% inorganic substances and 4% water, whereas dentin has 65% inorganic substances, 35% organic substances, and water. Cementum is made up of 45-50% inorganic substances, 50-55% organic substances, and water. Finally, alveolar bone has 65% inorganic and 35% organic substances.

In organic parts, dentin and cementum include type I collagens and various growth factors such as bone morphogenic proteins (BMPs). Type I collagen occupies about 90% of the organic parts of tissues, with the rest non-collagenous proteins (NCP), biopolymers, lipid, citrate, lactone, etc. NCPs include phosphoprotein, sialoprotein, glycoprotein, proteoglycan, osteopontin (OPN), osteocalcin, dentin matrix protein-1, osterix, and Cbfa1 (Runx2). These proteins are known to trigger the bone resorption and generation processes[9-12].

Based on the potentials of osteoconduction, osteoinduction, and osteogenesis through growth factors in tooth and similar histogenesis between tooth and bone, a novel bone graft material can be developed utilizing the inorganic and organic

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