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Original Article

Clinical evaluation of immediate implants using different types of bone augmentation materials

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ABSTRACT

Background: The immediate placement of implants into fresh extraction socket has proven to be a safe and predictable procedure. However, there is lack of scientific evidence regarding the healing pattern and osseointegration associated with immediate implants especially with different grafting materials.

Methods: A total of 30 patients male or female, with a mean age of 23.1 years ± 6.0 in the age group of 18–38 years, each having at least one tooth indicated for extraction (either maxillary or mandibular anterior teeth) were selected and randomly divided in to two groups. 30 Implants (Xive® friadent, Germany) were placed into fresh extraction sockets during this study. Two types of graft materials namely Dembone® (freeze-dried bone allograft) for group A and G-Bone® (modified hydroxyapatite) for group B were used. After implant placement all implants were evaluated clinically and radiographically at baseline, 3 months, 6 months, 9 months and 12 months. All clinical and radiographic parameters were subjected to statistical analysis. Intragroup comparisons were made with paired 't' test and intergroup comparisons with unpaired 't' test ($P > 0.05$ NS, ≤ 0.05 S, ≤ 0.01 HS).

Result: During the 1-year interval, no implant was lost and the mean bone level at the implants was maintained or even improved.

Conclusion: Immediate restoration of single tooth implants placed in fresh extraction sockets could be considered a valuable option to replace a missing tooth. The graft materials used in both groups have been found to be equally effective.

Introduction

The replacement of a tooth using an implant is derived from an evolution in concepts, technology, and clinical applications, following years of basic research and fundamental studies on the concept of osseointegration. The method of osseointegration, developed by many researchers, is well documented.[1] Due to the advantages provided by implant supported prosthesis,

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like improved esthetics, improved function, improved hygiene accessibility, and osseous preservation, all at a comparable cost, the single tooth implant replacement is a more viable option for today's patient than teeth supported fixed partial denture that involves preparation of adjacent teeth.

In situations where a tooth requires extraction and replacement, original protocol (gold standard) suggested a 6–12 month waiting period before implant placement. The original protocol has been challenged within the last decade and new protocols have been developed in which implants are placed at the time of extraction of the tooth. This protocol wherein implants have been placed at the time of tooth extraction is known as immediate implants. Since, the first report of the placement of a Tubingen® dental implant into a fresh extraction socket, there has been increasing interest in this technique.[2] Research and clinical studies on immediate implants in animals and humans have been encouraging.[3,4] Immediate implant placement was shown to have a failure rate of <5%, which is comparable to delayed placement. There is enough scientific evidence to support the procedures of immediate implant placement in comparison to the conventional two stage delayed protocol.[5]

Inspite of advanced diagnostic facilities, it is a real challenge to place an implant matching the extracted tooth dimensions. The space between the implant and bone is required to be filled in three dimensions with a biocompatible material for enhanced osseointegration. A number of graft materials are used for this purpose and these include the use of expanded poly tetra fluoro ethylene (ePTFE) membranes, bioabsorbable membranes, demineralized freeze-dried bone allograft (DFDBA), freeze-dried bone allograft (FDBA), bone autograft, hard tissue replacement polymer, connective tissue barriers, hydroxyapatite (HA), xenografts, use of growth and differentiation factors, particulate and block grafting materials and guided bone regeneration (GBR). As per scientific evidence, none of these materials had shown any superior outcome when compared in-vivo.[6,7] Therefore an 'in-vivo' study was undertaken to evaluate clinically and radiographically the success of immediate implant placement at the time of extraction with two commonly used graft materials i.e. Dembone® (Demineralized freeze-dried bone) and G-Bone® (modified hydroxyapatite granules). Even though these two materials are used extensively in regenerative procedures, there is no enough scientific literature to support their use in immediate implants.

Material and methods

A total of 30 patients male or female, in the age group of 18–38 years, each having at least one tooth indicated for extraction (either maxillary or mandibular anterior teeth) were selected and 30 implants were placed into fresh extraction sockets during this study. The patients selected were non-smokers, free from any systemic disease, non-bruxers, with sufficient quality and quantity of bone and prepared to comply with the follow-up and maintenance programme. Indications for tooth extraction and immediate implant placement included root fractures, endodontic failures, caries, internal resorption, external resorption, tooth with open apex and over-retained deciduous tooth. After approval from the local ethical committee, all the patients signed an informed consent form before starting the clinical protocols. After the routine preoperative investigations and treatment planning, Implants were placed in the subsequent appointments by single operator following standardized clinical and laboratory protocols.

Xive S® implants (Friadent®, Dentsply, Mannheim, Germany) used in this study were of root form threaded and internal hex design. Patients were divided in to two groups based on the graft material used. For group A, demineralized freeze-dried bone allograft (Dembone® Pacific Coast Tissue Bank, 2500-19 S, Flower St. Los Angeles) was used and for group B, modified hydroxyapatite (G-Bone®, Surgiwear Limited, Belgium) was used (Fig. 1).

Surgery was performed under local anesthesia (lignocaine 20 mg/ml with adrenaline 1:80,000). All the surgical procedures were carried under strict aseptic conditions. Teeth indicated for extractions were removed atraumatically. After evaluating the dimensions of the socket and findings of the CT scan, final decision regarding the dimensions of the implant was taken. Drilling of the osteotomy site was done according to the manufacturer instructions. Sequential drilling with copious irrigation was carried out till the desired dimensions were achieved depending on the selected implant. Implants of decided dimension were placed at a speed of 20–30 rpm using xive® implant driver. During implant placement care was taken that, angulation of placement was identical to that of the pre-existing tooth. Implants were placed 1 or 2 mm below the alveolar crest. Xive® implants are provided with an abutment for the option of immediate loading. In this study, since the implants were not immediately loaded they were separated from the abutment with hex driver and cover screw was placed. Discrepancies between the implant and walls of the prepared socket were measured and bone graft was placed (Figs. 2 and 3). 15 sockets received HA available in granule form and 15 sockets received DFDBA. The site was covered with snugly sutured flap. 5-0 silk sutures were used to achieve primary closure with the help of interrupted sutures. The oral hygiene instructions were given and the patients were followed up frequently. After Implant placement, all patients were recalled for evaluation of peri-implant soft tissue conditions, individual implant stability and radiographic marginal bone loss. All the implants were prosthetically loaded with porcelain fused to metal crowns after 6 months (Fig. 4).

Evaluation of the treatment outcome

Patients were evaluated with the following clinical and radiological parameters at baseline (BL), 3 months (3M), 6 months (6M), 9 months (9M) and 12 months (12M). All these parameters were evaluated for the implant (IMP) site as well as full mouth (FM) for comparisons.

Soft tissue evaluation

Soft tissue evaluation was done using modified Plaque Index, Gingival Index and probing depth. For modified Plaque Index and Gingival Index the implants were evaluated at four sites (buccal, lingual, mesial, and distal). Probing depth was also