Immediate 3-Unit Fixed Partial Denture as a Method to Preserve Intra-oral Tissue Integrity

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ABSTRACT
Background: Post-extraction alveolus undergoes resorption. Decreased bone volume affects restoring the missing tooth and surrounding tissues.

Purpose: The present review paper intends to supports the validity effect of fixed partial denture (FPD) installed immediately after tooth extraction to properly maintain intra-oral tissue integrity.

Materials and Methods: A Medline and manual search based on agreed search phrases was carried out to identify evidence that socket preservation and follow up procedures must be considered.

Results: In order to minimize volumetric bone changes, a well designed immediate construction of FPD should be considered as an excellent modality of treatment. Three dimension finite element (FE) analyses have shown increase stress/strains levels as a consequence of biological reactions and biomechanical stimuli necessary to preserve bone quality and subsequently tissue integrity.

Conclusion: Biomechanical quantification response of bone to mastication is a key in understanding the biological consequence of masticatory functions. Three dimensional FE analyses increase stress/strain levels and distribution after immediate installation of a 3-unit fixed partial denture. The use of a FPD improves a good long-term prognosis, intra-oral tissue integration and clinical success.

KEYWORDS
Alveolar residual preservation, Fixed partial denture, 3D finite element analyses, Biomechanics.

INTRODUCTION
Extraction socket wound healing is characterized by resorption of the alveolar bone at the extraction site. This produces a decrease in ridge volume, deformations of ridge contours, and, thus, difficulties in delayed placement of root-form implants or crown and bridge placement in an ideal position.1,2 Are socket and ridge preservation techniques at the day of tooth extraction efficient in maintaining integrity of the tissues? In recent years questions have arisen whether extraction sockets of future implant sites should be treated differently than sockets where no implant therapy will be done in the future. There is limited evidence on existing primary research from Medline and other search engines that provides reliable, up-to date evidence that socket and ridge preservation procedures must be considered at the day of tooth extraction.4,5 Related articles were selected and analyzed in detail.

Options for restoring a single tooth include fixed and removable partial denture, resin-bonded restoration and single-tooth implant. To select the most appropriate treatment for each patient, every case should be evaluated individually.6,7 Therapeutic options include the selection of appropriate treatment modalities based upon some specific conditions such as the soft tissue contour around pontics, efficiency, predictability, costs and aesthetic excellence.7,8

Since the last couple of decades of the 20th century, the concept of using oral implant supported fixed prostheses has also become an accepted therapy. However, in many instances implant treatment, when performed according to routine protocols, means that treated patients still have to use various types of transitional removable prostheses during parts of the clinical handling.9 From a functional point of view, treated patients may not be able to cope with the removable prostheses during healing phases, due to bad retention of the provisionals, or may even ask for an immediate treatment solution for socioeconomic reasons. The development of implant protocols, decreasing or even eliminating the healing periods support the installation of immediate prosthesis
After tooth extraction the alveolar socket undergoes to morphological changes during wound healing. The normal periodic turnover of bone is referred to as remodeling. In remodeling, old or damaged bone is removed during a resorption phase and new bone is formed in its place during a formation phase. Resorption is preceded by an activation phase in which the signal to remodel is initiated and transmitted. Remodeling is known to involve the interaction of external stimuli, bone cells, calcium and phosphate ions, and several proteins, hormones, molecules, and external factors. In order to minimize volumetric bone changes a well designed immediate construction of FPDs should be considered as an excellent modality of treatment. Several advantages have been shown; avoidance of surgical drilling, multi-surgical stages are reduced, design of the prosthesis is simplified, and it has an immediate positive psychological effect on the patient.

Therefore, the present review paper intends to support the validity effect of FPD installed immediately after tooth extraction to properly maintain intra-oral tissue integrity.

### THE BIOMECHANICAL BEHAVIOR OF FIXED PARTIAL DENTURES

In order to improve mechanical performance of a 3-unit FPD, a structural optimization of stresses and resistance should be done to obtain an adequate FPD design. Deformation of 3-unit FPDs during function may evoke a clinical misfit. However, such deformation has not been measured quantitatively, and the effect on deformation of the viscoelastic behavior of intraoral tissue structures is not well understood. The quantification of biomechanical response of mandibular bone to mastication is an integral component for a key in understanding the biological consequence of masticatory functions. Understanding the response of mandibular bone to external loading may also well explain the mechanisms of bone turnover. It seems to be quite important to determine the strain level distribution of FPDs during function since there is related evidence that correlates stresses distribution and local bone remodeling. The results provide important data for clinical assessment of constructing dentures or other restorative devices.

Removal of a tooth resulted in considerable variation of the stresses especially when the cortical shell is replaced by cancellous bone. If a FPD is placed tensile stresses tend to occur distal to the abutment teeth which theoretically could result in bone deposition. Then from a stress standpoint, the FPD can produce uniform stress distribution around the abutments and the external stimulus of tensile stress may account to maintain the quality of bone and surrounding tissue integrity.

### DYNAMICS OF TISSUE LOADING UNDER AN APPLIED FORCE

The tissues constituting the attachment apparatus, principally the alveolar portion of the periodontal ligament (PDL) and the surrounding alveolar and supporting bone, are markedly responsive to the stress placed upon the teeth during functional and para-functional forces and occlusal contacts. The response of a tooth and its adjacent structures to disuse has been ably described by Orban, Weinman, Sicher, Thoma and Goldman in 1975. A decrease of occlusal function lends to atrophic changes in the attachment apparatus and supporting bone. Three dimensional finite element (FE) simulating models determine stress/strain levels and distribution under different occlusal loading situations. The remodeling processes of the alveolar support structures are triggered by alterations in the stress/strain distribution in the periodontium.

The moment-to-force ratio, force magnitude, chewing forces and load transfer mechanisms on the stress/strain into the alveolar support structures and ortho-tooth movement (OTM) have been demonstrated by means of a FE analyses series. According to the classical OTM theories, symmetric zones of compression and tension are present in the periodontium. In the same way, three dimensional FE analyses may identify tensile stress over PDL and bone.

Three dimensional FE analyses has shown increase strains levels as a consequence of biological reactions and biomechanical stimuli necessary to preserve bone quality and subsequently tissue integrity. Thus, the present paper supported that FPDs installed immediately after tooth extraction properly maintains tissue integrity.

### CONCLUSION

Immediate 3-unit FPD is a predictable treatment option to preserve the quality of bone since tensile stress tends to occur distal to the abutment teeth resulting in bone deposition. To improve mechanical performance of a FPD, a structural optimization of stresses and resistance should be done to obtain an adequate denture design.

Biomechanical quantification response of bone to mastication is a key in understanding the biological consequence of masticatory functions. Dynamics of tissue loading under applied forces are markedly responsive to the stress placed upon the teeth during functional and para functional occlusal contacts. Three dimensional FE analyses determine stress/strain levels and distribution after immediate installation of a 3-unit FPD. To put it briefly in a phrase, “the use of FPDs improves the long-term prognosis, intra-oral tissue integration and clinical success”.

### REFERENCES


