Radiographic evaluation of two occlusal schemes of early loaded mini implant supported Mandibular overdenture

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INTRODUCTION

With the advent of new technologies and the overgrowing demand for implant treatment, root form implants are now available in many and different lengths and diameters to suit more and more clinical situations. Narrow diameter and *mini implants* are now available as therapeutic options for cases with space limitations, or when it is difficult to esthetically restore a small-sized tooth and install a standard-diameter implant on a narrow alveolar ridge without performing guided bone regeneration (GBR) procedures **(Vigolo and Givani 2000)**.

Mini implants offer several advantages. Their installation involves a flapless minimally invasive procedure with reduced bleeding, decreased postoperative discomfort (usually associated with flap surgery), shortened healing time, and decreased possibility to infection during surgical procedure. It is a preservative method of restoring patients with an atrophic mandible without any bone augmentation surgery with its possible complications (***Gibney 2001; Campelo and Camara 2002***)

Dental literature revealed that the ultimate success and longevity of dental implants are significantly influenced by the biomechanical aspects of occlusal design, configuration and anatomy **(*Rander et al 1989, 1997; Adell et al. 1990; Misch 1993; Kaukinen et al 1996; Schwartz 2000*)**. As reported by ***Jae-Hoon et al .2005*** one of the primary disadvantages of mini implants is the reduced resistance to occlusal loading as compared to standard sized implants. This makes the selection of an occlusal scheme in an overdenture supported by mini-implants even more critical and crucial, especially if they are to be early loaded.

Monoplane and lingualized occlusal schemes were principally designed to minimize occlusal forces falling on the supporting structures. In monoplane occlusion, cuspal inclination of posterior teeth is eliminated and consequently horizontal forces transferred to the supporting structures are significantly reduced ***(Jones, 1972)*** .Similarly, the lingualized occlusal concept eliminates the buccal cusp contact in centric and eccentric excursions hence provides wide occlusal freedom, reduces lateral interfences and reduces the possibility of harmful force contact and directions (***Becker et al 1977; Matsumara 2010)*.** However, which of the two occlusal schemes would be more protective and hence preferred when using early loaded mini-implants supporting mandibular overdentures? The present study was conducted in an attempt to answer this question.

DENTAL IMPLANTS

DEFINITION

A dental implant is defined as an alloplastic material implanted into the oral tissues beneath the mucosal and/or within the bone to provide retention and support for a fixed or a removable dental prosthesis (***The Academy of Prosthodontics 2005).***

Weiss and Weiss 2001 defined the dental implant as a device of biocompatible material(s) placed within or against the mandibular or maxillary bone to provide additional or enhanced support for a prosthesis or tooth.

Many published definitions of the dental implant include the concept that its purpose is to provide an abutment for restorative dentistry. However, this definition excludes the endodontic stabilizer, an implant that improves the prognosis of a compromised tooth, which then in turn may or may not be used as an abutment under prosthesis (***Weiss and Weiss 2001)***.

CLASSIFICATION OF DENTAL IMPLANTS

1-Endodontic endosteal dental implant:

It is the implant that extends through the root canal of a tooth into periapical bone used to stabilize a mobile tooth and it is also called an *endodontic stabilizer* (***The Academy of Prosthodontics 2005)***.

Although endodontic stabilizer implants are endosteal implants, they differ from other endosteal implants in terms of functional application. Rather than providing additional abutment support for restorative dentistry, they are used to

extend the functional length of an existing tooth root to improve its prognosis" and when required, its ability to support bridgework (***Weiss and Weiss 2001)***.

2-Mucosal inserts:

A Mucosal insert has been defined as any metal form attached to the tissue surface of a removable dental prosthesis that mechanically engages undercuts in a surgically prepared mucosal site. It is also called button implant, intra-mucosal insert or mucosal implant (***The Academy of Prosthodontics 2005)***.

Weiss and Weiss 2001 defined them as mushroom shaped titanium projections that are attached to the tissue surface of a partial or total removable denture in the maxilla!" and plug into prepared soft-tissue receptor sites in the gingiva to provide additional retention and stability. The authors explained that intra-mucosal inserts differ in form, concept, and function from the other modalities as they provide retention for a prosthesis but do not provide abutments. They are usually indicated in patients for whom endosteal or subperiosteal implants are not deemed to be practical or desirable.

3-Subperiosteal implant:

The subperiosteal implant is an eposteal dental implant that is placed beneath the periosteum while overlying the bony cortex (***The Academy of Prosthodontics 2005)***.

Unlike endosteal implants, subperiosteal implants are placed under the periosteum and against bone on the day of insertion, rather than within alveolar bone. They are usually indicated in cases of advanced alveolar resorption, in which the volume of the residual available bone is insufficient for the insertion of an endosteal implant (***Weiss and Weiss 2001)***.

Roy et al. 1996 reported that mandibular subperiosteal supported and retained implant prostheses successfully served many patients who could not successfully use conventional mucosa-supported complete dentures.

Dorsey et al .2004 conducted a study in which they placed subperiosteal implants in atrophic mandibles of 40 patients. They reported that all subperiosteal implants were successfully remained in place with no pain, and all patients reported high satisfaction with their prostheses

4-Endosteal dental implant:

An endosteal dental implant has been defined as a device placed into the alveolar and/or basal bone of the mandible or maxilla and transecting only one cortical plate (***The Academy of Prosthodontics 2005)***. The endosteal dental implant is composed of an anchorage component, termed the endosteal dental implant, which, ideally, is within the bone, and a retentive component, termed the endosteal dental implant abutment. The abutment connects to the dental implant (by means of screws, thread/screw interfacing, compression/ luting agent etc. that can be termed elements), passes through the oral mucosa, and serves to support and/or retain the prosthesis (fixed dental prosthesis, removable dental prosthesis, maxillofacial prosthesis) (***The Academy of Prosthodontics 2005)***.

Endosteal implants comprise one broad category of implants and are the most commonly used dental implants nowadays (***Weiss and Weiss 2001, Pye et al .2009)***.

According to their shape, endosteal implants are classified into:

(4a) Transosteal dental implant:

It is defined as the dental implant that penetrates both cortical plates and passes through the full thickness of the alveolar bone (***The Academy of Prosthodontics 2005)***.

Misch 2008 described the implant as composed of a metal plate (with retentive pins for holding it against the inferior border of the mandible) which supports transosteal pins that penetrate through the full thickness of the mandible and pass into the mouth in the parasymphyseal region.

Among endosteal implants, transosteal implants are the most surgically invasive, technique-sensitive and their placement is usually a hospital based procedure. As with ramus frame implants they are limited to the mandible. Although transosteal implants have proven safety and efficacy, they are not commonly used because of their complexity and the demands they make on both the practitioner and the patient (***Weiss and Weiss 2001)***.

Barbara et al .1989 treated 190 patients with bone heights that ranged from 4 to 18 mm (with an average of 10 mm) using mandibular transosteal implants. Results of the 5-year longitudinal study revealed that 182 of the 190 implants (95.8%) were stable and functional. The authors reported that the transmandibular implants have acceptable predictability and reliability for reconstruction of patients with severely resorbed mandibular ridges.

(4b) Ramus frame implant:

It is a dental implant design that consists of a horizontal intraoral supragingival abutment in the form of a bar and endosteal implant body segments that are placed into the rami and symphysis areas as one section (implants fabricated from one piece of metal), or two sections (implants of anterior and horizontal segments that are connected at the time of placement), or

five sections (an implant consisting of five sections in which the endosteal implant body segments are independently placed and connected with fitted parts) (***The Academy of Prosthodontics 2005)***.

Ramus frame implants have been demonstrated to be safe and effective. They are indicated for the treatment of completely edentulous mandibles with severe alveolar ridge resorption, however they are not commonly used because of technique-sensitivity (***Weiss and Weiss 2001)***.

c) Blade-form implant:

A blade-form implant is defined as a faciolingual narrowed, wedge-shaped dental implant body with openings or vents through which tissue may grow (***The Academy of Prosthodontics 2005)***. As its name suggests, the basic shape of the plate/blade form implant is similar to that of a metal plate or blade in cross-section. Some plate/blade forms have a combination of parallel and tapered sides (***Weiss and Weiss 2001)***.

Plate/blade form systems are supplied in one-stage and two-stage varieties. One-stage plate/blade form implants are fabricated of one solid piece of titanium, with the abutment continuous with the body of the implant. Two-stage plate/blade form implants are supplied with detachable abutments and healing collars (***Weiss and Weiss 2001)***.

As with root form implants, plate/blade form implants can be placed anywhere in the mandible or maxilla where there is sufficient available bone. However, because of their narrower bucco/labio-lingual width, plate/blade forms tend to be applicable in a wider range of available bone presentations, especially in posterior ridges (***Weiss and Weiss 2001)***. According to ***Masaki***