

Effect of Dental Implant Stability on the Periodontium: A Prospective Study

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Abstract

Introduction: Many factors influencing the implants stability including composition of bone, design of implants, torque of placement, and operational techniques. The aim of this study is to assess the effect of dental stability on the periodontium surrounding the dental implant.

Methods: This study was conducted retrospectively among patients who received dental implants at several dental clinics in Saudi Arabia. The stability was assessed by compressions using Strumann Trouqing ratchet, while clinical examination was conducted for complications including tooth mobility, bleeding, pus and periodontists. The relations correlations between the stability and the outcomes were investigated. The p value less than 0.05 was considered statistically significant.

Results: A total of 29 dental implants were examined in this review. The most prevalent outcome was periodontitis, as about 17% of the dental implants were presented with moderate periodontitis and only one dental implants had severe periodontitis. Tooth mobility had 5.2% prevalence among the included dental implants. The peri-implantitis was only in one case which accounted for 1.7% and no exudate was reported. Association between primary stability and tooth mobility was significant ($p < 0.001$), whereas the association between stability and inflammation were not statistically significant.

Conclusions: The stability of dental implants are an important factor in the success of dental implant. The most prevalent complications of dental implants were periodontitis, tooth instability, whilst peri-implantitis was uncommon outcome.

Keywords: Implant, Tooth stability, Periodontitis, Failure, Complications

Introduction

The initial stability is the lack of mobility in bone-to-implant interface immediately after dental implant placement [1]. It has a biologically similar concept to that applied for bone reduction after occurrence of fracture, as the restriction of movement in the bone ends is important for healing process [2]. A stress can be produced by a small movements even at the micromotion level (50-150 μm) which can lead to bone resorption and hinder the osteointegration of the implant [3].

To improve success rates of dental implants have been increasingly reported in the recent decade [4]. There are two concepts related to dental implant stability: primary and secondary. Mechanical engagement of an implant with surrounding bone is associated with primary stability, whereas the secondary stability is determined by the bone regeneration and remodeling phenomena. Primary stability is a biometric characteristic which has an important role in the long-term durability of the implant, other factors include shape of bone bed, composition of bone and control of infection at the site of insertion [5].

The stability of dental implant is known as a lack of mobility in bone-to-implant interface immediately after dental implant placement [1]. It has a biologically similar concept to that applied for bone reduction after occurrence of fracture, as the restriction of movement in the bone ends is important for healing process [2]. A stress can be produced by a small movements even at the micromotion level (50-150 μm) which can lead to bone resorption and hinder the osteointegration of the implant [3]. Many factors influencing the implants' primary stability including composition of bone, design of implants, torque of placement, and operational techniques. Assessment of primary stability can be conducted by devices such as Periotest, Osstell, and insertion torque [6]. Literature showed a poor prognosis for implants inserted in poor bone in terms of quality and quantity. The bone density is important for a good primary stability, therefore a pre-assessment of bone structure is necessary for implants success [7, 8]. Researchers

found an insertion torque of 32 Ncm as indication of primary stability [9]. The aim of this study is to assess the effect of dental stability on the periodontium surrounding the dental implant.

Methods

This study was conducted retrospectively among patients who received dental implants at several private dental clinics. The initial stability was assessed by compressions by Strumann Trouqing ratchet either between 2 adjacent implants or between symmetrical bilateral implants with different initial stability. The impact on the periodontium was assessed by investigating for complications such as radiographic radiolucency, presence of exudate, periodontal pocket, and tooth mobility. Examination of periodontal pocket which was graded into mild, moderate, and severe periodontitis using periodontal probe. Clinical assessment of major signs of peri-implantitis which included gum bleeding and pus exudate. In addition to clinical evaluation of long-term tooth mobility as a sign of implant prognosis. This radiographic and clinical assessment was conducted by two examiners. First, the patients and x-rays were assessed by the examiners independently then both examiners assessed the controversial cases together to achieve the consensus. The data about patients' characteristics and the measurement of primary stability were collected in the clinical assessment form filled in at implant insertion stage. The consents were obtained from patients and the confidentiality of the provided information was ensured.

The data were introduced into computer and Statistical Package of Social Science (SPSS) Version 26 was used to analyze data. The study variables were demonstrated in descriptive statistics including frequencies, percentages, mean and SD. The associations between primary stability and complications associated with dental implants were assessed using Chi-square test. Pearson correlation was conducted to estimate the association between study variables, and p value less than 0.05 was considered statistically significant.

Results

A total sample of 29 of dental implant was evaluated in this study with mean age of patients was 45 ± 4.6 years old with unbalanced gender composition of 68.4% females and 31.6% males. The most common complications of dental implants were periodontitis, where 17.2% of the dental implants had moderate periodontitis and only one dental implants (1.7%) had severe periodontitis. Tooth mobility was a less common complication with 7.1% prevalence among studied sample. The inflammation of the implants was uncommon as 3.5% of the dental implants associated with peri-implantitis and no pus exudate was reported by any case (table 1). Good initial stability was reported in 53.4% of the dental implants, while poor initial stability was reported in one dental implant. A significant association was detected between initial stability and tooth mobility ($p < 0.001$), while the associations between initial stability and inflammatory complications such as periodontitis and peri-implantitis were found statistically non-significant.

Discussion

After implant insertion, the stability decreases in the following few weeks to the minimum due to the interposition of fibrous tissues, then increases again to reach the secondary stability that achieved by bone modeling and osteointegration [10]. The use of similar types and shapes of the implants allowed for control of the confounding effect for such factors in both implant stability and prognosis. This study aimed to evaluate the association between initial implant stability and the health of the surrounding periodontium. The primary stability that measured immediately after implant insertion was found related to secondary stability, strength and resistance to movement of the implant, which resulted in good prognosis of the treatment [7, 8]. The present study found an excellent primary stability in 44.8% of the implants with maximum primary stability was 35 n/cm. A good initial stability was reported in 53.4% of the dental implants, while poor initial stability was reported in one dental implant.

Table (1): Patients characteristics and effects associated with dental implants

<i>Characteristics</i>	<i>Frequency</i>	<i>Percent (%)</i>
<i>Gender</i>		
<i>Male</i>	9	31.6
<i>Female</i>	20	68.4
<i>Infection of implant site</i>		
<i>Bleeding</i>	1	3.5
<i>No</i>	28	96.5
<i>Pus formation</i>		
<i>Yes</i>	0	0.0
<i>No</i>	29	100
<i>Tooth instability</i>		
<i>Yes</i>	2	7.1
<i>No</i>	28	92.9
<i>Periodontitis</i>		
<i>No/mild</i>	14	46.6
<i>Moderate</i>	5	17.2
<i>Severe</i>	1	3.5
<i>Drop-out</i>	9	31.6

This can be attributed to good bone quality of selected patients because they are middle aged with mean age 50 years old and narrow standard deviation of 5 years. Bone quality, in terms of amount and density, is an important prerequisite for good primary stability of dental implants [7].

Causes of early wound infection can be attributed to poor stitching, insufficient flap reflection, or premature loading of the implant with crowns or bridges. These criteria were evaluated in this study and the most common complications of dental implants were periodontitis followed by tooth mobility and peri-implantitis. The commonly used criteria of implant success included tooth mobility,

radiographical measurement of bone loss, absence of inflammatory signs, and pocket depth in relation to fixed reference point [11]. The inflammation of the implants was uncommon as 1.7% of the dental implants associated with peri-implantitis and no pus exudate was reported by any case. A study conducted by Quirynen et al. who recruited 509 implants and found a higher infection percentage of 4% around the implants which accounted for a third of early failures [12]. However, they found signs of infection are not adequate to assess the prognosis of implant. The tooth mobility in conjunction with inflammatory signs such as pain and discomfort are strong characteristics of implant failure, however pain alone is not adequate as many failed implants are asymptomatic [13]. The present study demonstrated that 5.2% of the implants had tooth mobility.

Tooth mobility is the most important sign of failed implants even in the absence of radiographic bone loss. Horizontal and vertical tooth movements are indication of improper osseointegration and implant failure, while rotational movement alone is a sign of insufficient bone implant interface [14]. In the present study, a significant association was detected between initial stability and tooth mobility. This finding reflected the long-term success of implants, in term of non-mobile implants, which had excellent or good primary stability immediately after insertion. In this study, about 19% of the dental implants had moderate periodontitis and only one dental to severe periodontitis. This diagnosis was made based on pocket depth, however the question to which reference point the pocket depth was assessed. Use of periodontitis as a criteria of implant failure is still controversial due to the difficulty in determining amount of bone loss [15].

Conclusions

Based on the findings, the initial stability of dental implants was significantly related with long-term tooth mobility. The most prevalent complication of dental implants was periodontitis and tooth mobility, while uncommon complications were bleeding, pus exudate or peri-implantitis.

Conflict of interests

The authors declared no conflict of interests.

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