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DENTAL IMPLANT AND PERIODONTAL HEALTH: A RETROSPECTIVE ANALYSIS

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Abstract

Introduction: The stability of dental implants is affected by various elements, including the bone's composition, implant design, insertion torque, and surgical techniques. This research aims to explore how the stability of dental implants impacts the health of the surrounding periodontal tissue.

Methods: A retrospective analysis was carried out on patients who underwent dental implant procedures in various clinics across Saudi Arabia. Implant stability was measured using the Strumann Torquing ratchet for compressive assessment, and clinical evaluations were performed to identify any complications such as tooth mobility, bleeding, pus formation, and signs of periodontitis. Statistical analyses were used to explore the correlation between implant stability and these clinical outcomes, with a significance level set at $p<0.05$.

Results: In this study, 29 dental implants were scrutinized. Periodontitis emerged as a significant complication, with 17% of the implants showing moderate periodontitis and one implant exhibiting severe periodontitis. Tooth mobility was observed in 5.2% of the cases. Peri-implantitis was identified in a single case, representing 1.7% of the total, and there were no reports of exudate. A significant correlation was found between the primary stability of the implant and tooth mobility ($p<0.001$), although no significant statistical relationship was observed between implant stability and the presence of inflammatory conditions .

Conclusions: Dental implant stability plays a crucial role in the overall success of the implantation process and the health of the periodontium. The study found that periodontitis and tooth mobility were the most common complications following implantation, with peri-implantitis being relatively rare.

Keywords: Dental Implants, Periodontal Health, Stability, Periodontitis, Implant Complications

Introduction

The concept of initial stability refers to the absence of movement at the bone-to-implant interface immediately following the placement of a dental implant. This principle bears a biological resemblance to the processes involved in bone healing after a fracture, where limiting motion at the fracture site is crucial for successful recovery. Even slight micromovements (ranging from 50 to 150 μm) can generate stress that leads to bone loss and obstructsthe process of osseointegration, which is vital for the implant's integration with the bone.

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].

Recent years have seen a notable improvement in the success rates of dental implants, attributable to a deeper understanding of implant stability, distinguished into primary and secondary stages. Primary stability involves the mechanical connection between the implant and the surrounding bone, while secondary stability is achieved through bone growth and remodeling around the implant. Factors influencing primary stability include the bone bed shape, bone composition, and infection control at the implantation site. Moreover, various tools like Periotest, Osstell, and insertion torque measurements are used to evaluate this stability, highlighting its significance in the implant's longevity. To improve success rates of dental implantshave 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 infectionat 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 biologicallysimilar 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 retrospective study involved patients from multiple private dental clinics who had undergone dental implant procedures. Initial stability was measured using the Strumann Torquing ratchet, focusing on comparisons between implants or symmetrical bilateral implants with differing levels of initial stability. The study aimed to observe any periodontal complications, such as radiographic changes, exudate, periodontal pocket formation, and tooth mobility, with periodontitis severity categorized via periodontal probing. Key signs of peri-implantitis, including gum bleeding and pus exudate, were also evaluated alongside long-term tooth mobility to predict implant success. Assessments were carried out independently by two examiners, with consensus reached on controversial cases. Patient data and primary stability measurements were meticulously recorded at the time of implant placement, with informed consent obtained from all participants to guarantee the confidentiality of their information. The Statistical Package for the Social Sciences (SPSS) Version

26 facilitated data analysis, employing descriptive statistics, Chi-square tests, and Pearson correlation to explore the relationship between implant stability and periodontal outcomes, considering a p- value of less than 0.05 as statistically significant. This comprehensive approach aims to shed light on the pivotal role of dental implant stability in preserving the health of the surrounding periodontium, underlining the necessity for meticulous assessment and technique in implant placement to ensure optimal outcomes.

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 andinflammatory 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 modelingand osteointegration [10]. The use of similar types and shapes of the implants allowedfor control of the confoundingeffect for such factors in both implant stability and prognosis. This study aimed to evaluate the association betweeninitialimplant stability andthe 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

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