

Original Research

Assessment of bite pressure between single implant prosthesis and natural teeth: A comparative study

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ABSTRACT:

Background: The present study was conducted for comparative evaluating bite pressure between single implant prosthesis and natural teeth. **Materials & methods:** A total of 20 patients scheduled to undergo prosthetic rehabilitation of missing mandibular first molar by dental implant were enrolled. A thorough case history of the patient was taken. A clinical examination of the patient was done to meet the inclusion criteria and rule out the exclusion criteria. Twenty patients were divided into two groups. Group A: having implant prosthesis on the right side and Group B: having implant prosthesis on the left side. As natural teeth are periodontally sound, and implant prosthesis was osseointegrated. The patient was instructed to use their strongest bite to complete one bite across the bite sheet. The bite scan analysis was consulted on the results. Evaluation of all the results was done using SPSS software. **Results:** Mean maximum pressure of the Implant prosthesis on right side and contralateral side natural teeth was 35.23 MPa and 31.12 MPa respectively. Mean maximum pressure of the Implant prosthesis on left side and contralateral side natural teeth was 30.41 MPa and 26.71 MPa respectively. While comparing the results, significant results were obtained. **Conclusion:** Records of maximum bite pressure can be very useful in preserving the tissue health of implants and the tissues surrounding them.

Key words: Implant, prosthesis, Teeth

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INTRODUCTION

A dental implant is one of the treatments to replace missing teeth. Their use in the treatment of complete and partial edentulism has become an integral treatment modality in dentistry. Dental implants have a number of advantages over conventional fixed partial denture. A dental implant is a structure made of alloplastic materials implanted into the oral tissues beneath the mucosa and/or periosteum and/or within or through the bone to provide retention and support for a fixed or removable dental prosthesis.¹⁻³ Dental implants are placed endosseously, and the bone is the ultimate bearer of the occlusal load. Patients are not uniform in the maximum bite force they can generate. The occlusal biting load in the posterior jaw is usually about three times of that found in the anterior.⁴ It is possible for supporting implants to be overloaded by the patients' biting force, resulting in bone loss and failure of the fixture.

Bite force measurement may be an important parameter when planning dental implant treatment. Some patients can generate extreme biting loads that may cause a luxation of the fixture and subsequent loss of osseointegration.⁵ A patient with low biting force may be able to have a successful long-term outcome even with poor anatomical bone qualities. Patients with a high bite force capability may have an increased risk for late component fracture or implant failure.⁶ Hence; the present study was conducted for comparative evaluating bite pressure between single implant prosthesis and natural teeth.

MATERIALS & METHODS

The present study was conducted for comparative evaluating bite pressure between single implant prosthesis and natural teeth. A total of 20 patients scheduled to undergo prosthetic rehabilitation of missing mandibular first molar by dental implant

were enrolled. A thorough case history of the patient was taken. A clinical examination of the patient was done to meet the inclusion criteria and rule out the exclusion criteria. Twenty patients were divided into two groups. Group A: having implant prosthesis on the right side and Group B: having implant prosthesis on the left side. As natural teeth are periodontally sound, and implant prosthesis was osseointegrated. To assess occlusal contacts, the patient was instructed to bite into a centric relation on thin articulating paper with very little force. Light biting force should not come into contact with the implant crown. There was no longer any touch with the implant prosthesis. In order to achieve equal contact between the implant crown and natural teeth, the patient was then instructed to apply additional occlusal power to the articulating paper, equivalent to their regular chewing force when eating. The variations in movement between the implant prosthesis and the teeth will be explained by this "timed" contact. The patient's bite was taken at the second visit. The patient was instructed to sit up straight and had their head moved to a straight position. The patient was instructed to use their strongest bite to complete one bite across the bite sheet. The bite scan analysis was consulted on the results. Evaluation of all the results was done using SPSS software.

RESULTS

Mean maximum pressure of the Implant prosthesis on right side and contralateral side natural teeth was 35.23 M Pa and 31.12 M Pa respectively. Mean maximum pressure of the Implant prosthesis on left side and contralateral side natural teeth was 30.41 M Pa and 26.71 M Pa respectively. While comparing the results, significant results were obtained.

Table 1: Mandibular pressure record: Implant prosthesis on right side and contralateral side natural teeth

Side	Mean	SD
Natural	35.23	10.23
Implant	31.12	9.74
p-value	0.00 (Significant)	

Table 2: Mandibular pressure record: Implant prosthesis on left side and contralateral side natural teeth

Side	Mean	SD
Natural	30.41	9.74
Implant	26.71	8.65
p-value	0.00 (Significant)	

DISCUSSION

Oral health problems affect about 3.5 billion people worldwide, with an estimated 267 million people suffering from tooth loss. Tooth loss is often associated with trauma, periodontal disease and caries, which may affect the individual's health not only in aesthetic and social issues, but also by

impairing chewing, speech, and increasing the risk of developing diseases. One of the worst oral health conditions is the complete loss of dentition, known as edentulism, which although preventable, is still a common problem worldwide. In this context, dental implants emerged as the main form of treatment for total or partial tooth loss, replacing mobile dentures that were anchored in remaining teeth or soft tissue, and which, as a consequence, caused their alteration over time. Among the different materials found on the market, titanium implants are the most used due to their biocompatibility and low cost.⁷⁻⁹ The masticatory force achieved with the prosthetic rehabilitation techniques is an indicator of prosthetic success. The maximum bite force is an indicator of the masticatory performance of the elevator muscles combined with craniomandibular biomechanics. Evaluation of maximum bite force is applied in various situations including the diagnosis of masticator muscle related pathologies, determination of prosthetic success with different designs and evaluation of discrepancies in the craniomandibular complex. The bite force analysis could be carried out by direct and indirect methods. The direct approach can be through a device called transducer, introduced between the upper and lower jaw.^{6, 8, 10} Hence; the present study was conducted for comparative evaluating bite pressure between single implant prosthesis and natural teeth. Mean maximum pressure of the Implant prosthesis on right side and contralateral side natural teeth was 35.23 M Pa and 31.12 M Pa respectively. Mean maximum pressure of the Implant prosthesis on left side and contralateral side natural teeth was 30.41 M Pa and 26.71 M Pa respectively. While comparing the results, significant results were obtained. Maximum occlusal bite force (MBF) among patients with an implant-supported fixed prosthesis was assessed in a previous study conducted by Al-Omiri MK et al. Forty patients (20 males and 20 females, mean age = 42.7 ± 9.6 years) with an implant-supported fixed prosthetic rehabilitation on one side and dentate on the other side were recruited into this study. Participants' MBF were measured bilaterally at the first molar region using a digital hydraulic occlusal force gauge (GM10). The measurements were repeated three times (with 45 s intervals between times) for each side, and the highest value of the bite force (MBF) was recorded for each side. The mean MBF was 577.9 N at the implant-supported prosthesis side and 595.1 N at the dentate side. The average MBF was higher at the dentulous side (P < 0.05). Maximum occlusal bite force was higher in males and participants with higher weight and height. However, BMI was not significantly related to MBF values. Maximum occlusal bite force values at the dentate side were slightly (3%) but significantly higher than MBF at implant-supported prosthesis side.¹⁰ Khubchandani et al, in another previous study, correlated the maximum bite force (MBF) and

electromyography (EMG) activity before and after 24 hours and two months of rehabilitation of the missing permanent first molar with single-implant crowns. This observational, prospective in-vivo type of study was done on 10 patients receiving dental implants for missing molars. There was a significant correlation between bite force and EMG activity post-treatment. Dental implant therapy can be very well utilized for the replacement of single missing teeth.¹¹

The effects of single posterior implant restorations delivery on the redistribution of bite force was evaluated in another previous study conducted by Zhou et al. The occlusal force of implant-supported prostheses was significantly ($P = .000$) lower than those of the control natural teeth at the baseline, then no significant difference was found with that of the mesial teeth at 3 months, and finally it was significantly ($P = .000$) lower than that of the distal teeth at 6 months; meanwhile, it significantly ($P = .008$) increased by a mean of 2.04 times from 2 weeks ($3.39 \pm 2.61\%$) to 3 months ($6.90 \pm 4.77\%$), whereas no significant difference ($P = .900$) was found from 3 months ($6.90 \pm 4.77\%$) to 6 months ($7.31 \pm 4.60\%$). In addition, the bite force of the posterior segment on the restored side of both unilateral and bilateral gaps was significantly ($P = .013, .001$) improved by 3.31% and 6.83%, respectively, although the discrepancy in bite force significantly ($P = .039$) increased from an initial 3.52% to 5.02% for subjects with bilateral defects, accompanying increases in the proportion (15.38%) of the level III bilateral bite force deviation.¹²

CONCLUSION

Records of maximum bite pressure can be very useful in preserving the tissue health of implants and the tissues surrounding them.

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