Journal of Advanced Medical and Dental Sciences Research

@Society of Scientific Research and Studies *NLM ID:* 101716117

Journal home page: www.jamdsr.comdoi: 10.21276/jamdsr Index Copernicus value = 91.86

(e) ISSN Online: 2321-9599; (p) ISSN Print: 2348-6805

Original Research

Assessment of effect of the implant abutment types and the dynamic loading on initial screw loosening

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ABSTRACT:
Background: Edentulism continues to be an oral health challenge with a growing interest, especially due to the increase in life expectancy in industrialized countries. The present study was conducted to assess effect of the implant abutment types and the dynamic loading on initial screw loosening. **Materials & Methods:** Three groups of abutments were produced using different types of fabrication methods; stock abutment, gold cast abutment, and CAD/CAM custom abutment. Removal torque before loading and after loading were evaluated. **Results:** The mean removal torque before loading was 18.6 Ncm in group I, 16.4 Ncm in group II and 16.1 Ncm in group III. The mean removal torque after loading was 17.3 Ncm in group I, 16.1 Ncm in group II and 15.8 Ncm in group III. **Conclusion:** The abutment system did not have a significant impact on initial screw loosening.

Key words: abutment, torque, screw loosening

Received: 18 November, 2021 Accepted: 23 December, 2021

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This article may be cited as: Bhatt D, Khan FA, Vamshi NS, Ashwati, Krishna BJ, Yeso A. Assessment of effect of the implant abutment types and the dynamic loading on initial screw loosening. J Adv Med Dent Scie Res 2022;10(1):73-76.

INTRODUCTION

Edentulism continues to be an oral health challenge with a growing interest, especially due to the increase in life expectancy in industrialized countries; therefore, in the last decades, implant prosthetics have become exponentially popular in both adult and elderly populations.[1,2] This growth in demand has forced prosthodontics, as a dental specialty, to be systematically challenged by the incessant changes in the conception and therapeutic approach of dental implants, as well as by the abundance of materials and manufacturing methods available today for the replacement of lost tissues in the stomatological area.[3] Implant abutments can be either stock, cast custom or CAD/CAM custom abutments. The primary advantage of stock abutments is their lower initial cost.[4] On the other hand, the ideal anatomic contour and emergence profile cannot be reproduced with stock abutments.[5] Gold cast abutments are made specifically for the patient's individual tooth that the corresponding implant replaces.[6,7] The present study was conducted to assess effect of the implant abutment types and the dynamic loading on initial screw loosening.

MATERIALS & METHODS

This invitro present study comprised of three groups of abutments were produced using different types of fabrication methods; stock abutment, gold cast abutment, and CAD/CAM custom abutment. A customized jig was fabricated to apply the load at 30° to the long axis. The implant fixtures were fixed to the jig, and connected to the abutments with a 30 Ncm tightening torque. A sine curved dynamic load was applied for 105 cycles between 25 and 250 N at 14 Hz. Removal torque before loading and after loading were evaluated. Results thus obtained were subjected to statistical analysis. P value less than 0.05 was considered significant.

RESULTS

Table I Distribution of abutment system

Groups	Group I	Group II	Group III
Abutment system	Stock abutment	Gold cast abutment	CAD/CAM custom abutment
Number	10	10	10

Table I shows distribution of abutment system.

Table II Removal torque value between abutment systems

Groups	Removal torque value before loading	P value
Group I	18.6	0.15
Group II	16.4	
Group III	16.1	

Table II, graph I shows that mean removal torque before loading was 18.6 Ncm in group I, 16.4 Ncm in group II and 16.1 Ncm in group III. The difference was non- significant (P>0.05).

Graph I Removal torque value between abutment systems

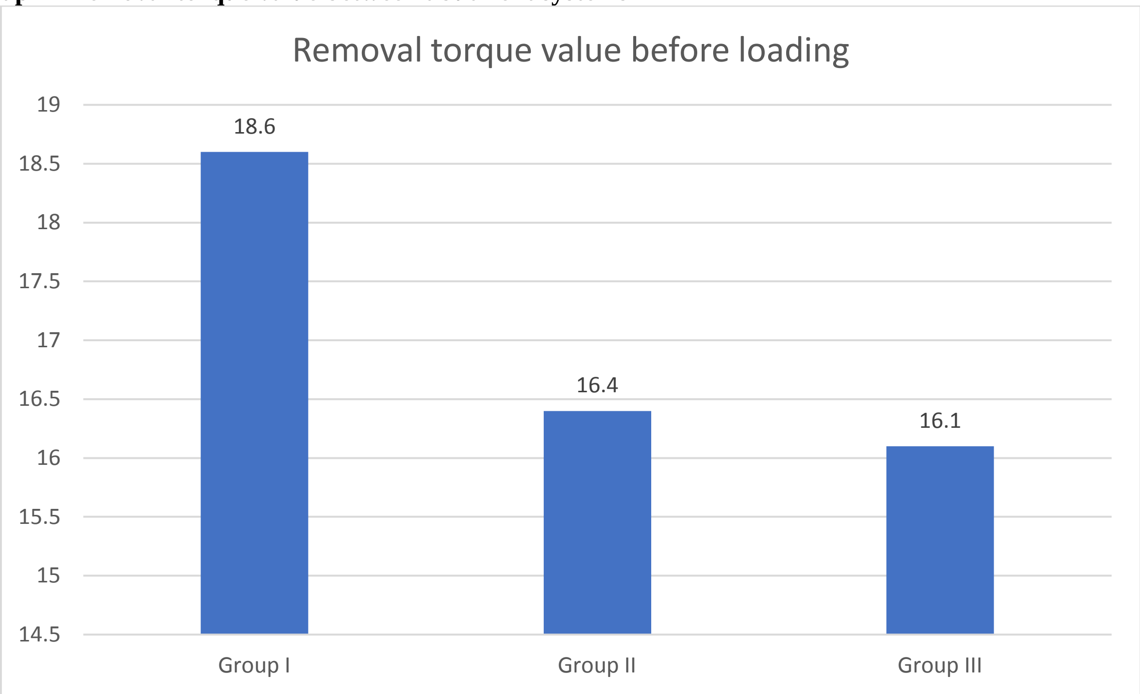
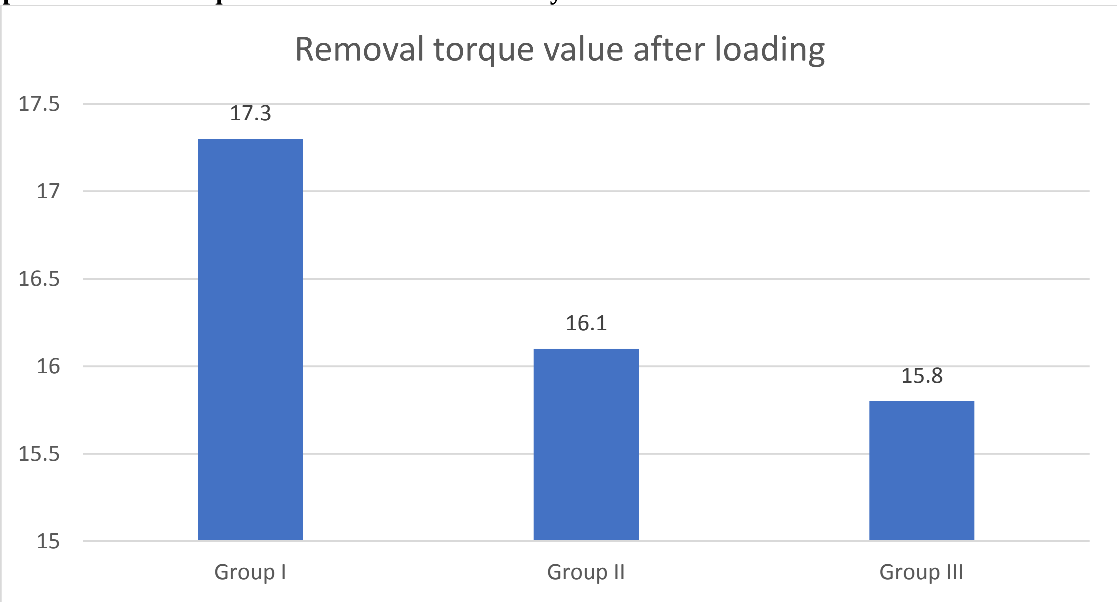


Table III Removal torque value between abutment systems

Groups	Removal torque value after loading	P value
Group I	17.3	0.15
Group II	16.1	
Group III	15.8	

Table III, graph II shows that mean removal torque after loading was 17.3 Ncm in group I, 16.1 Ncm in group II and 15.8 Ncm in group III. The difference was non- significant (P> 0.05).

Graph II Removal torque value between abutment systems



DISCUSSION

Dental implants to replace missing teeth have become a predictable treatment modality for partially and totally edentulous patients; a long-term survival rate of 95.2% has been documented.[8] In contrast to implant survival, implant success has been defined in relationship to the amount of marginal bone loss (MBL) occurring over time.[9,10] The use of the platform-switching feature at the implant-abutment junction; the use of prosthetic abutments, as a titanium base or multiunit abutments of >2 mm; and achieving a mucosa thickness >2 mm at implant placement determine success rate.[11,12] The present study was conducted to assess effect of the implant abutment types and the dynamic loading on initial screw loosening.

In present study, mean removal torque before loading was 18.6 Ncm in group I, 16.4 Ncm in group II and 16.1 Ncm in group III. Kim et al[13] in their study 3 groups of abutments were produced using different types of fabrication methods; stock abutment, gold cast abutment, and CAD/CAM custom abutment. The removable torque value before loading and after loading was the highest in stock abutment, which was then followed by gold cast abutment and CAD/CAM custom abutment, but there were no significant differences.

An implant abutment connection has a great impact on screw loosening. Screw loosening occurs on the slip joint of the external hex in the external connection type by vibration and micro-movement during functional loading.[14] It appears that the external connection type is particularly weak to screw loosening because all external force components are concentrated mainly on the abutment screw. On the other hand, in the internal connection type, less screw loosening occurs compared to the external connection type because of the oblique shape of the fixture to the abutment connecting surface which enhances the mechanical stability by the friction and wedge effect.

We found that mean removal torque after loading was 17.3 Ncm in group I, 16.1 Ncm in group II and 15.8 Ncm in group III. Haack et al[15] measured the amount of elongation of the cervical part and thread during tightening with a gold screw and a titanium screw. In the case of the elongation quantity of a screw, a gold screw showed better quality than a titanium screw, and the preload generated in a gold screw was larger than that in a titanium screw. This means that the use of diverse screws would affect the research result. Therefore, screws with the same composition were applied in all three groups.

Vetromilla et al[16] in their study found that of the 891 articles identified, 29 were selected and analyzed. The most common technical complications were abutment screw loosening and crown-cement loosening, while dehiscence and recession were the most common biological complications. The most frequent complications were dehiscence for external hexagon, crown-cement loosening for the internal hexagon, and ceramic fracture for the Morse taper. Esthetics were favorable for all connections, but the internal hexagon performed better. However, better results for marginal bone loss, success, and survival were found for the Morse taper. The global annual failure rate was 0.90% and 0.2% for Morse taper, 0.3% for external hexagon, and 2.2% for internal hexagon. This review suggests that Morse taper performs better for survival, success, and marginal bone loss. Internal hexagon performed better for esthetic parameters. Additional controlled studies are needed to provide stronger evidence because the evidence generated in this study was considered low.

CONCLUSION

Authors found that the abutment system did not have a significant impact on initial screw loosening.

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