



## Effect of Wet Field on the DE Torque Values of Abutment Screws

Pravinya Sam, Suresh Venugopalan, Dhanraj Ganapathy\*

Department of Prosthodontics, Saveetha Dental college, Saveetha Institute of Medical and Technical Sciences, Chennai, Tamil Nadu, India

### Article History:

Received on: 14 Jul 2020  
Revised on: 15 Aug 2020  
Accepted on: 23 Aug 2020

### Keywords:

Abutment screw,  
Detorque values,  
Torque values,  
Screw loosening,  
Wet Field

### ABSTRACT

Screw loosening is amongst the most prevalent mechanical problems in dental implant prosthetics. Clinicians will know if the reverse Detorque values are compromised by contamination of the implant abutment screw hole either by blood, saliva or saline. Research have shown that the drying of the implant cavity may decrease the preload value when the abutment screw is closed and thereafter increase the likelihood of abutment screw loosening. Mobility of the prosthesis, or screw fracture and increase the risk of peri-implant soft-tissue inflammation. This study aims to assess and compare the effect of wet and dry fields while torquing the abutment screws on the DE torque values. 40 Nobel bio care implant analogues mounted in plaster models were used in this study. The samples were divided into four groups dry abutment screws, artificial saliva, blood and normal saline. All the abutment screws were tightened till 20 Ncm and left aside for 15 minutes. After 15 minutes the abutment screw were DE torqued, and the DE torque values were noted for tall the groups. When analysed using paired sample t-test there was no significant difference with artificial saliva ( $p=0.269$ ). There was statistical difference with blood ( $p=0.00$ ) and with saline ( $p=0.00$ ). Based on this study, the presence of saliva decreases the DE torque values of the abutment screws, whereas Blood and saline increase the DE torque values of the abutment screws. The presence of blood clot might be the reason for the increase in DE torque values which might decrease once the clot disintegrates. Clinicians should prevent contamination of the screw hole by blood and saliva; if contamination arises, sanitation of the infected screw and also the screw hole until final tightening is advised.



### \*Corresponding Author

Name: Dhanraj Ganapathy  
Phone:  
Email: [dhanrajmganapathy@yahoo.co.in](mailto:dhanrajmganapathy@yahoo.co.in)

ISSN: 0975-7538

DOI: <https://doi.org/10.26452/ijrps.v11iSPL3.3034>

Production and Hosted by

IJRPS | <https://ijrps.com>

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### INTRODUCTION

Dental implants offer a predictable treatment modality for the replacement of missing teeth. Evidence shows a significant improvement in the quality of life of patients who have received dental implants. Dental implants currently have a success rate of 90 % – 100 % and show promising results due to the advances in their physical design and manufacturing process and improved clinical experience (Fillion *et al.*, 2013).

Forces originating either from the functional or para-functional occlusal impact of the human teeth may eventually lead either in physiological tolerance of the tissues of the attachment system or if

beyond the adaptive ability of the host, could result in damage to the occlusal trauma. Because osseointegrated implants have really no periodontal ligament, there can be no occlusal trauma. Detrimental forces caused by occlusal operation can result in mechanical difficulties of the components of the implant, i.e. the loosening of the screw, the fracturing of the screw or the fracturing of the fixture.

The intensity of preload is driven by variables such as the strength and manner of load applied, the nature and configuration of the implant abutment, environmental influences influencing the connections (lubrication of the screw threads), the location and stability of the screw and the occurrence of surface irregularities which impede the full fit of the screw as well as abutment (Theoharidou *et al.*, 2008; Micarelli *et al.*, 2013). Too low torque value results in screw loosening while excessive torque increases the risk of screw fracture. Thus, accurate torque application is critically important. Too high torque value results in screw fracture. Apart from this repeated insertion and removal during the manufacturing process in the lab results in frictional wear that results in screw loosening.

Screw loosening is amongst the most prevalent mechanical problems in dental implant prosthetics. Clinicians will know if the reverse Detorque values are compromised by contamination of the implant abutment screw hole either with blood, saliva or saline. Research has already shown that drying of the implant compartment may reduce the preload value when the abutment is closed. screw and subsequently amplify the danger of abutment screw loosening, mobility of the prosthesis, or screw fracture and increase the risk of peri-implant soft-tissue inflammation (Buser *et al.*, 2019; Shafie, 2014). This study aims to assess and compare the effect of wet and dry fields while torquing the abutment screws on the detorque values.

## MATERIALS AND METHODS

40 Nobel biocare implant analogues mounted in plaster models were used in this study. Based on the "Power and Sample Size for Dose-Response Studies" the number of samples to be evaluated in for our current study arrived at 40 with power set at 80 % based on study.

The samples were divided into four groups one control group with dry abutment screws (Group A), in the second group the abutment screws were wetted with artificial saliva (Group B), in the third group the abutment screws were wetted with blood (Group C) and in the fourth group, the abutment screws were wetted with normal saline (Group D) (Figure 1). All

the abutment screws were tightened till 20 Ncm (Figure 2) and left aside for 15 minutes. After 15 minutes, the abutment screw were detorqued and the detorque values were noted for all the groups (Figure 3).



Figure 1: Different Groups

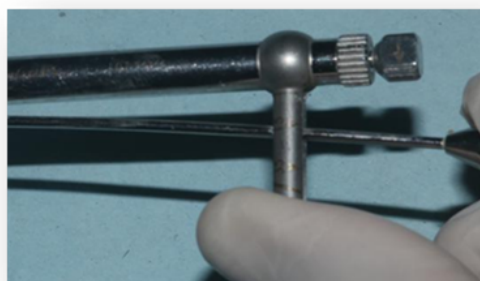


Figure 2: Torque value

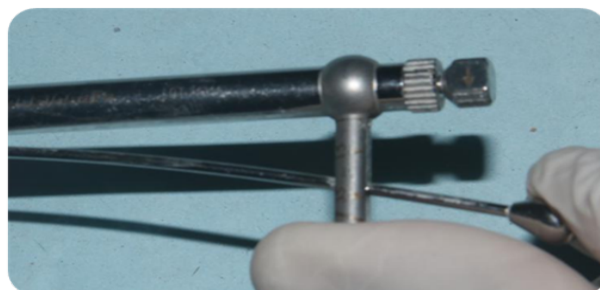


Figure 3: Detorque values

**Table 1: Detorque values of the experimental groups**

Groups [n=10]	Detorque Values(N/cm <sup>2</sup> )	P value ( $\alpha=.05$ )
Group A(Dry field)	19.5± 3.68	-
Group B(Artificial saliva)	17.5± 2.63	p=0.269
Group C(Blood)	31.5±3.37	p=0.00
Group D(saline)	31±3.9	p=0.00

## RESULTS

The results were analysed using SPSS software version 20. Paired sample t-test was performed to compare between the groups. The mean detorque value for Group A in the dry field (control) was 19.5± 3.68 N/cm<sup>2</sup>, Group B in artificial saliva was 17.5± 2.63 N/cm<sup>2</sup>, Group C in Blood was 31.5±3.37 N/cm<sup>2</sup> and Group D in saline was 31±3.9 N/cm<sup>2</sup> respectively. There was no significant difference with control and artificial saliva (p=0.269). There was statistical difference with control and blood (p=0.00) and with saline (p=0.00) (Table 1).

## DISCUSSION

The durability of the implant-supported prosthesis is determined by many factors including passive fit, precision machining, implant and abutment stability, respectively. In solitary-tooth implant restoration work, the connection of the implant/abutment has been clinically shown to be unreliable. If two pieces are affixed by a screw, the screw could only loose whenever the external forces exerted are greater than the internal forces. Throughout this way, a most important factor is the force created in response to the application of the torque, also recognized as preload (Bickford, 1998). The preload tends to keep the screw threads in direct contact with the implant threads, produces a compressive force between the screw head and the seat platform. As per few researchers, the preload values are calculated with the following factors: the distribution of torque, the form of screw alloy, the size of the screw head, the abutment ingot, the implant substrate and the lubrication (Francischone, 2008; Nikolopoulou, 2006). There are few studies in the literature investigating the interaction of Reverse torque values and the wet field. Based on the results of our study, the presence of saliva reduces the detorque values were found in another study where the saliva penetration did not raise the detorque values of the titanium abutment screws. Remnants of saliva can infiltrate micro gaps, transferring microorganisms and proteoglycans into the implant-abutment interface, functioning as a lubricant, with viscoelastic substances distributing loads and decreased fric-

tion (Schoenbaum, 2018).

Given the high threat of blood contamination of that same abutment screw hole, particularly in bone-level implants throughout surgery and testing-in stages, no standardized studies on blood infiltration of the abutment screw hole was reported in the literature. It is likely that considering the massive protein content and the existence of macromolecules such as fibrinogen and platelets, blood contamination may contribute to the creation of a thinner film on the surfaces of titanium implants (Wang et al., 2009). Based on the results of our study, the presence of blood increased the detorque values. Upon immediate contact with blood, the interaction between the metal surfaces begins as the platelets are attached to the metal surface. The findings of this study indicate that the deposition of a biofilm on the abutment screw substrate could have a negative impact on the performance of Detorque. The viscosity of the blood can play a crucial role. However, following the disintegration of the blood clot, the Detorque values may reduce (Gumus et al., 2014; Koban et al., 2011).

Based on the results of our study, the presence of Saline increases the Detorque values of the abutment screws. Saline is a mixture of Sodium chloride in water. The saline solution upon drying has crystalloid sodium chloride particles that affect the detorque values of the abutment screws (Bhola et al., 2011; Sharma et al., 2008). Few studies show that the lubrication or wetting the screw surface can generate higher preload values. One possible reason is during screw tightening there is still a slipping tension between the abutment threads and the interior threads of the implants. This stress is not evenly distributed. Presence of moist media removes most internally generated thread shearing forces, given that certain internal implant sections have been flooded with artificial saliva. Another explanation could be that, when the abutment threads reach their ultimate location within the implant, certain places on the sides and valleys of the threads could not be wetted with saliva. Non-uniform resistance develops under detorque forces that results in final value greater than the first observed data.

The clinician should be aware of the effects of different substances on the torque and detorque values of the abutment screw. Additional efforts should be taken to use different screws for fabrication in the lab and for patients use to minimise the mechanical wear (Corazza *et al.*, 2014; Martin *et al.*, 2001). The microstructural deterioration of the abutment screw surface morphology may be observed with clinical procedures requiring the insertion and removal of abutment screw. When the degradation progresses, the detorque values have been shown to decline as relative to the torque values and, when the threshold is reached, the threads of the abutment screw detach from either the grooves of the inner surface of the implant and the abutment tends to rotate within its own axis, creating a clinical dilemma. Presence of fluids in the implant cavity should be assessed for bone level implants before tightening the abutment screws. Saline irrigation can be done to rinse of any blood or saliva in the implant cavity.

## CONCLUSION

According to this study, the presence of saliva reduces the detorque values of the abutment screws, while Blood and saline increase the detorque value of the abutment screws. The presence of blood clot may be a cause for a rise in detorque values that will decrease after the clot has disintegrated. Clinicians should prevent contamination of the screw hole by blood and saliva; if contamination arises, sanitation of the infected screw and the screw hole until final tightening is advised. Thus it is important to tackle this problem in order to secure the eventual success of dental implants.

## Conflict of Interest

The authors declare that they have no conflict of interest for this study.

## Funding Support

The authors declare that they have no funding support for this study.

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