REVERSE TORQUE VALUES IN INDEXED ABUTMENTS

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ABSTRACT

Mechanical stability of implant-abutment set is fundamentally important for the success in implant supported rehabilitation. For this, the knowledge about torque removal values is essential. In this way, the objective of this work was to evaluate the torque reverse values in indexed abutments of Morse Taper system. Five Morse taper implants with their respective abutments were tested (n=5). Each abutment received a sequence of two consecutive torques in insertion (15Ncm) with an interval of ten minutes, and one reverse torque, all measured by digital torque wrench. The t-student test with 5% significance was used to evaluate the data. The analysis of results showed there is statistical significant difference in reverse torque values between the insertion torque value and reverse torque value intra-group, the indexed abutments presented an average percentage of torque loosing of 15% (P=0.002). It is possible to conclude that the use of indexed abutments of Morse taper system presented statistical significant reduction of reverse torque values, which in turns increase the risk of no biomechanical instability.

KEYWORDS

Abutments. Morse taper. Morse taper with index. Reverse torque.

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INTRODUCTION

Currently, dental implants allow the return of functional and aesthetic characteristics to edentulous and partially edentulous patients, and the successful osseointegration of these implant systems has been well documented. [1,2,3] In this way, some researches are developed towards new techniques, materials, designs and indications that can optimize the biomechanical behavior of implants and their prosthetic components.[4] In relation to the connection of this system, passivity, adaptation and bond strength of abutment to the implant are fundamental requirements, and relaxation or fracture are undesirable or considered failure in implantology. [5] These mechanical damages are related to the micro-movements of intermediate abutment, when under occlusal forces, increasing the risk of relaxation and consequently, the appearing of a marginal gap. [6,7]

The reverse torque value of screws is considered a relevant indicator for evaluation of stability of connections implant-abutment.[8] Removal torque values near or superior to the initial torque indicate a good prognosis for these connections. [9,10]

Sutter et al. (1993)[11] asserted that between the insertion torque and removal torque of abutment is the main difference. According to these authors, removal torque of abutments in the traditional screw design is 10% lower than the insertion torque, and in the tapered screw used in the Morse taper system, the removal torque is from 10 to 20% higher than the first inserted torque. The internal taper configuration introduced to the bond system between the abutment and the implant is characterized by adaptation through friction between metal surfaces, called by some authors as cold welding.[12, 13] In this way, this system shows a superior mechanical behavior when compared with the external hexagon, due to the pre-loading and to the friction between implant-abutment interface, which have a crucial role in the maintenance of complex integrity.[14,15]

Kim et al. (2012)[16] observed and compared the removal torque values in four different solid and screwed abutments (n=7) with internal taper connection, before and after mechanical cycling tests in 150N. The values measured before and after load tests showed that the mean removal torque was 5% lower than the insertion torque values. However, after the application of loads, the values of abutment removal presented an average increase from 10% to 15% on insertion torque abutment values, which shows, in some groups, the presence of cold welding between the interface implant/ abutment.

In a systematic review, which has investigated the incidence of screw relaxing of abutment in single tooth restorations, the

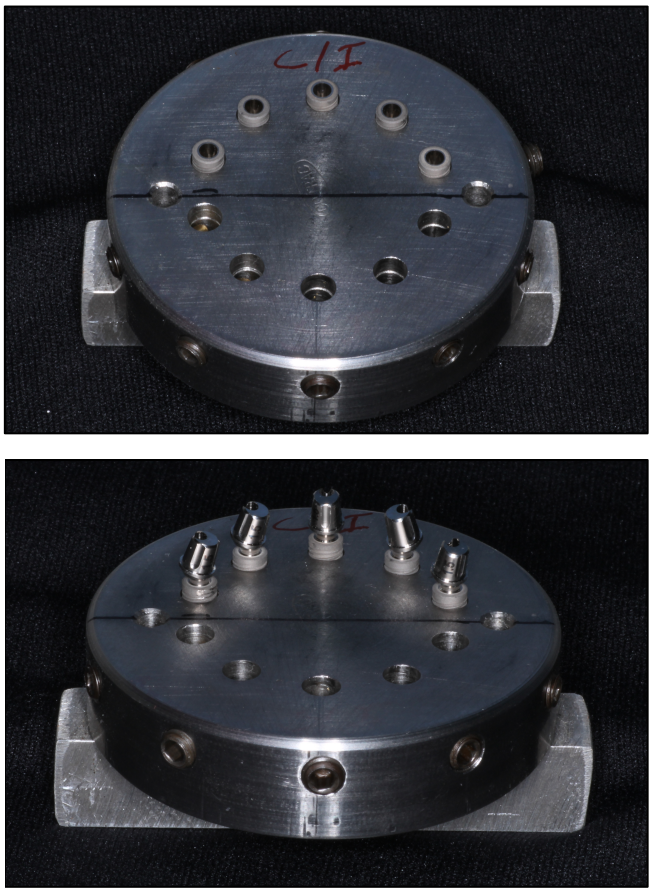
authors have concluded that this event is uncommon, notwithstanding the geometry of abutment-implant connection.[17] Changes in the Morse taper system design commercially introduced in order to facilitate prosthetic procedures suggest changes in the stability of complex implant-abutment. The introduction of a hexagonal index of positioning between the implant and the abutment could improve the stability of setting, acting in the strength to rotational forces generated during mastication, further the friction between conical walls of system.[18] Semper et al. (2009)[19] added that a minimizing looseness in the contact area of implant-abutment, and the establishment of standardization of manufacturing tolerances are essential parameters for these indexed implant systems may promote positional stability. Because of this, the aim of this study was to evaluate the torque reverse values in indexed and non-indexed abutments of Morse Taper system.

The null hypothesis was the non-existence of significant statistical differences between the insertion torques and reverse torque of evaluated components indexed.

MATERIAL AND METHODS

To perform this work was used 5 Alvim CM (Neodent ®, Curitiba, Brazil) implants with Morse taper connection of 4.3 mm diameter and 10 mm height with internal hexagonal index of positioning. The sample was composed by five Universal CM abutment 17º CM Exact® (Neodent ®, Curitiba, Brazil) with internal hexagon indexation with 15 Ncm torque. The standardized inclusion of implants in a stainless steel base, settled with a transversal steel screw was used to prepare the specimens. The stainless steel base was pressed in a vise (Fig. 1 A, B).

Figure 1A and B: Standardized inclusion of implants in a stainless steel base settled with transversal steel screw.

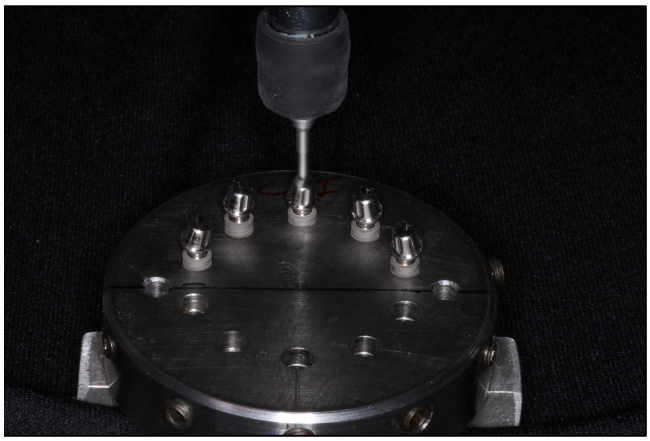


After the specimens and their bases were settled in, the tightening torque was applied. The torque was performed in each component according to the manufacturer's recommendations. For this, an axial digital torque wrench with nominal range 15 to 150 Ncm 0.1 Ncm resolution

(TOHNICHI ® i, model STC50CN, No. 703224S manufacturing, Japan) was used.

Before the prosthetic screw insertion in the implant, 1 mL of sterile saline was applied in the internal threads of the implant with a pipette, in order to simulate the buccal environment. The key indicated to the system was coupled to the digital torque wrench (Fig.2) according to the manufacturer's protocol, in order to obtain all the insertion of screws. After 10 minutes, the screws were tight with the same torque value to minimize the sliding engagement between the threads and to achieve the optimum pre-load. 20

Figure 2: Application of tightening torque on abutments by digital wrench.



The implant-abutment sets had their reverse torque measured five minutes after the application of the second tightening torque. To perform the measurement, the specimens were settled in a vise, and the same digital torque wrench was used for the application of initial torque of settle was also used to obtain the values of reverse torque (Fig. 3). The specific key for each system was used with the torque wrench (Neodent ®, Curitiba, Brazil).

Figure 3: Measure of reverse torque values of abutments by digital wrench.

For the analysis of the difference between the insertion and reverse torque obtained values of indexed abutments, the results were submitted to the statistic model of independent samples with the t-student test, establishing the significance level in 5%. The force power (P= 0.05) was used to determine the minimum sample size.

RESULTS

The analysis of force power in this study was 90%. The averages and standard deviations of insertion and reverse torques of samples are shown in Table 1. After the analysis of the results, it was possible observe statistical significant difference intra-group on reverse torque comparing to the insertion torque (P=0.002).

Table 1: Comparison of insertion and removal torque after 5 minutes in indexed components.

Removal torque after 5 minutes	Tightening torque	Removal torque	Absolute difference	Relative difference
Median	15	12,69	-2,31	15,4
Deviation Standard	0	0,71	0,71	4,77
P Value		0,002		

Comparison perfomed through T-student test

DISCUSSION

The results in this work reject the null hypothesis of non-existence of significant statistical differences (P>0.05) between the initial torque and remove torque in the components evaluated (P=0.02).

Theoharidou et al. (2008)[17] asserted that anti-rotational characteristics are essential for the success of systems for implant-abutment connection. However, in this study in which Morse taper systems with anti-rotational systems were evaluated, the performance of indexed abutments presented a reduction of reverse torque 15.4%, what could suggest the importance of a higher frictional contact during the rotation of abutment. [2,4,11,15]

Similar results were verified in study performed by Kim et al. (2012)[16], in which 4 groups of implant-abutments with internal conical connection presented a reduction in the values of abutment removal of 5% in relation to the initial torque. Nevertheless, after the application of loads, these results changed, and showed a significant increase in the removal torque values in some components with 10 to 15% of variation. Therefore, the incidence of axial loads which was not performed in this study could increase the removal torque values of non-indexed components, due to the higher frictional contact between the components.

By observing that groups analyzed by Kim et al. (2012)[16] in which there were not components with anti-rotational characteristics, it is possible assert that new studies are necessary in order to evaluate the interference of this geometry in the removal torque values of abutments after application of mechanic loads.

Steinebrunner et al. (2008)[10] reported that a higher force is always necessary to tight the screw for its liberation. For Sutter et al. (1993)[11], the connection Morse taper ITI® Dental Implant System, with an internal angle of 8º results in a removal torque from 10 to 20% higher than in the moment of insertion torque, after mechanical cycling. In this research there were no results found of abutment torque removal higher than the insertion torque values indexed abutments. It can be justified by the absence of mechanical cycling, in addition to a possible interference of devices with rotational characteristics in

indexed components present, which do not allow the rotational friction, characteristic of components with conical interface. [18,20]

This interference can be analyzed before the variety of studies that have demonstrated the superiority of systems with conical interface, in relation to the external hexagon systems. It is possible observe that the key factor for higher retention of abutments is based on the frictional union provided by its components; then, for an evaluation addressed to the frictional relation of this system, there was the necessity to standardize other factors which could interfere. [8,9,13,14]

It is important consider that it was an in vitro test, and the cyclic loading was not examined. A study with application of loads for analysis of behavior of these different geometries of Morse taper abutment would be necessary.

CONCLUSION

With the limitations of an in vitro methodology is possible conclude that: the indexed components presented significant statistical reduction ($p<0.05$) of torque values when compared with insertion torque.

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