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Comparison of clinical and radiographic changes in peri-implant tissues in two implant connection designs

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ABSTRACT
A dental implant is known as a piece composed of a biocompatible material that is inserted into the bone to replace the root of a tooth. There are different types of designs for internal connections between the implant and the abutment. Among the most commonly used are the conical connection (CC) and the internal hex connection (HI), the choice of one of them can determine the prognosis of the procedure. That said, a cross-sectional case report study was carried out where 10 implants inserted in 3 patients were observed, and clinical parameters such as probing depth, presence of bleeding, redness and gingival exudate were analyzed. In addition, radiographs measured the distance between the bone crest and the implant platform, on the mesial and distal surfaces, to assess bone loss. In this sense, it was observed that the conical connection presents better stability of the clinical and radiographic parameters.

Keywords: Implant connections, Peri-implant disease, Dental implants, Peri-implant tissue.

1 INTRODUCTION

The clinical use of dental implants has managed to stand out for decades, its evolution process shows success in terms of osseintegration. (1) A variety of materials and designs are offered on the market that aim to improve both physical and mechanical characteristics. These variations directly impact the biological behavior of the implants.

Among the most commonly used connections today are the internal hexagonal and the conical(2) [0], and in turn the choice of connection determines the different interfaces that are part of the implant system, such as implant-bone, implant-fixation screw, implant-abutment and finally abutment-fixation screw.

It is clear that the implant-abutment interface determines peri-implant bone loss to a large extent. The space virtually exists between the components and allows the filtration of fluids that promote the growth of microorganisms and the invasion of the peri-implant biological width. Hence, the prevention of this bacterial microfiltration becomes a challenge in the implant industry. Therefore,

it was relevant to carry out this research to observe and compare the characteristics concerning the clinical parameters in CC and HI connections.

2 MATERIALS AND METHODS

In this case report study, 10 ODONTIT IMPLANT SYSTEMS implants were observed (Made of type 5 titanium, with a rough surface due to double acid etching and "sand blasted") of which 5 of them had a conical connection (CC) and the other 5 with internal hexagonal connection (HI), were installed during the period between 2017 and 2018 in the dental clinic of the Antonio Nariño University (Armenia campus, Quindío, Colombia). The selected patients had the same number of implants of each connection, which allowed the implementation of a crossover design in which each patient was his or her own control, with each of the implants as the unit of analysis.

2.1 INCLUSION CRITERIA

1. Patients of legal age.
2. Upper or Lower Partial Edentulous.
3. Bacterial plaque index less than 15%, measured by the O'Leary Index.
4. Systemically suitable for implant placement.
5. Acceptance to participate in the study, signing the provided informed consent.
6. That they will have a complete institutional dental medical history, with their respective informed consents filled out and signed.

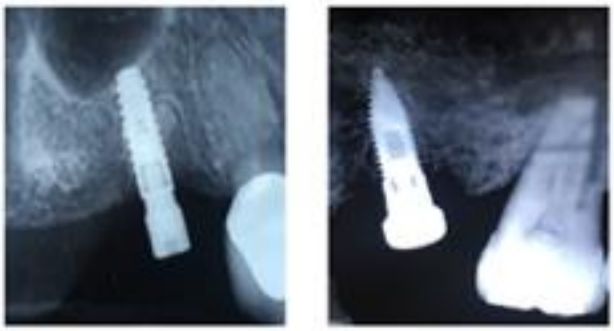
2.2 EXCLUSION CRITERIA

1. Pregnancy or breastfeeding status.
2. Systemically compromised where the placement of implants is not suitable, including diseases such as diabetes, immunological alterations, cognitive disability or any condition that may alter the course of treatment.
3. Reported allergy to any of the medications and devices to be used during the study.
4. Patients undergoing treatment with bisphosphonates and/or corticosteroids.
5. Smokers.

The clinical characteristics were collected through the elaboration of an oral clinical examination that included a complete periodontogram including the dental implants, periapical x-rays were also taken of the alveolar areas where the implants were installed. To analyze the behavior of the peri-implant tissues around the two types of connection, 2 controls were carried out, the first one 1 month after the placement of the implants and the second 3 months after the first control, both clinical and radiographic data were collected. Variables such as probing depth (PS), i.e., the distance from the

gingival margin to the depth of the gingival sulcus, the presence of bleeding, redness, and gingival exudate were measured. In the radiographic images , the distance between the bony crest and the implant platform was measured with a scale (scale 1:100 millimeters), taking into account the mesial and distal surfaces.

Figure 1 X-ray of implants with conical and internal hexagonal connection



In addition, the data obtained in the clinical and radiographic controls were entered into a Microsoft Excel database (Office 2013) and all data management and statistical tests were performed using the SPSS statistical program.

3 RESULTS

In the radiographic analysis, an average of the measurements of the mesial and distal areas obtained by each implant was made, obtaining as a result a single measurement for each one. After this, the averages were grouped according to the implant design in order to consolidate the information for analysis.

In a similar way, it was carried out with the clinical component, for which the depth of probing was measured, all the areas that were probed were averaged (mesial vestibular, medial vestibular, distal vestibular, lingual or mesial palatine, lingual or middle palatine and lingual or distal palatine), and accordingly a measurement was obtained for each implant. which was then consolidated and classified according to the implant design, the variables of bleeding and exudate were also examined and grouped. (Table 1).

Table 1: *Averages of quantitative variables.*

I am a student	**Number of implants**	**Control 1**		**Control 2**	
		Average (mm)	**Standard deviation**	**Average (mm)**	**Standard deviation**
X-ray control	10	1,35	0,875	1,30	0,761
Drillhole depth	10	3,09	0,968	2,60	0,966

On the other hand, Table 3 shows that radiographic bone loss in the hexagonal connection group was greater than that in the conical connection group. In addition, in the hexagonal it increased; while

in the conical it decreased. However, the probing depth behaved differently: in the HI group it decreased and the CC group remained stable, this can be explained by the greater retraction of the soft tissues that occurred in the first group according to the radiographic examination of bone loss. (See Table 2)

Table 2: *Averages of quantitative variables, according to the design of the implant connection.*

I am a student	Implant Type	Number of implants	Control 1		Control 2	
			Average (mm)	Standard deviation	Average (mm)	Standard deviation
X-ray control	Hexagon	5	1,75	0,750	1,85	0,487
	Conical	5	0,95	0,873	0,75	0,559
Drillhole depth	Hexagon	5	3,45	1,018	2,80	1,303
	Conical	5	2,73	0,865	2,40	0,547

Later, qualitative variables can be observed during the first and second controls, where it was determined whether or not there was the presence of bleeding (See Table 3), the presence or not of exudate (See Table 4) and the presence or not of redness (See Table 5) for each connection design, in none of these variables was a difference observed.

At the radiographic level and in terms of probing depth, there was a decrease in the distance between the bone crest and the implant platform in both types of connections, however, in the conical connection a lower depth to the probing and a shorter distance were identified radiographically. On the other hand, as for the sign of bleeding, no hexagonal connection implant presented it in the first control, but there was one of them that bled in the second. Regarding the gingival exudate, no implant presented this sign in either the first or the second control. On the other hand, redness was found in the second control in a conical connection implant, where it should be noted that this event did not occur during the first control.

The analysis of the quantitative variables did not show a difference for either of the two connections, since the averages of all implants remained within a similar margin within the standard deviation.

Table 3: *(Qualitative variable) Presence of bleeding at clinical check-ups.*

Bleeding on probing		Number of implants	Control 1		Control 2	
			No	Yes	No	Yes
Implant Type	Hexagonal	5	0	5	1	4
	Conical	5	2	3	2	3
Total		10	2	8	3	7

Table 4: *(Qualitative variable) Presence of exudate in clinical controls.*

Presence of exudate		Number of implants	Control 1		Control 2	
			No	Yes	No	Yes
Implant Type	Hexagonal	5	5	0	5	0
	Conical	5	5	0	5	0
Total		10	10	0	10	0

Table 5: *(Qualitative variable) Presence of exudate in clinical controls.*

Presence of redness		Number of implants	Control 1		Control 2	
			No	Yes	No	Yes
Implant Type	Hexagonal	5	5	0	5	0
	Conical	5	5	0	4	1
Total		10	10	0	9	1

4 DISCUSSION

The main focus of this research was to identify clinical differences between the conical and hexagonal connection to support decision-making in the practice of implantology in dentistry.

In line with these approaches, D'Ercole, et al.(3) found that the presence of spaces in the connections undoubtedly facilitates bacterial migration, which could be the result of contamination in the stages of implant placement or transmission of the oral environment, which automatically facilitates the development of peri-implant inflammation.

Yepes and Balseca (4) compared in vitro the bacterial colonization of the abutment-implant interface between dental implants with an internal hexagon connection design and a conical connection. However, for this particular project, implants with an internal hexagon connection design showed lower bacterial permeability than conical connections.

On the other hand, Khorshidi, et al.(5) also conducted an in vitro study with follow-up for 14 days in which, according to the results, the conical connection seems to be more efficient in controlling filtration. All this coincides with the argument of Huang, et al. (6), where it was evident that the conical design decreased the tensions by up to 32% in the cortical region and by 17% in the trabecular region, therefore, their conclusion is based on the fact that the use of conical implants could reduce the maximum tension in both the cortical and trabecular bone. Morris, et al. (7) who found that the internal taper shape of the implant allows for secure settling of the prosthetic abutment Which is why, the precision fit of the tapered abutment inside the implant prevents loosening and rotation of the abutment, as well as the invasion of food residues and bacteria.

In this order of ideas, it can be concluded that, based on the results, the conic connection obtained better results compared to the hexagonal one. However, it is necessary to emphasize that not only do the results vary according to the connection of the implant, but they are also subject to the habits of each patient, including oral hygiene and their biological characteristics. Additionally, this study is subject to review and possible deepening, since the sample is relatively small and does not allow us to establish with certainty and veracity which of the two connections has a better prognosis than the other.

REFERENCES

Narang P, Arora A, Bhandari A. Biomechanics of implant abutment connection : A review. Indian J Stomatol. 2011;2(2):113–6.

Kapos T, Ashy LM, Gallucci GO, Weber H-P, Wismeijer D. Computer-aided design and computer-assisted manufacturing in prosthetic implant dentistry. Int J Oral Maxillofac Implants [Internet]. 2009;24 Suppl(April 2014):110–7. Available from: http://www.ncbi.nlm.nih.gov/pubmed/19885438

D'Ercole S, Scarano A, Perrotti V, Mulatinho J, Piattelli A, Iezzi G, et al. Implants with internal hexagon and conical implant-abutment connections: An in vitro study of the bacterial contamination. J Oral Implantol. 2014;40(1):31–6.

Interno H, Morse YC, Od A, Patricia L, Calderón Y. UNIVERSIDAD CENTRAL DEL ECUADOR INSTITUTO SUPERIOR DE INVESTIGACIÓN Y POSGRADO COLONIZACIÓN BACTERIANA DE LA INTERFASE PILAR - Quito , Diciembre , 2016. 2016;

Khorshidi H, Raoofi S, Moattari A, Bagheri A, Kalantari MH. In Vitro Evaluation of Bacterial Leakage at Implant-Abutment Connection: An 11-Degree Morse Taper Compared to a Butt Joint Connection. Int J Biomater. 2016;2016(Figure 1).

Huang H-L, Chang C-H, Hsu J-T, Fallgatter AM, Ko C-C. Comparison of implant body designs and threaded designs of dental implants: a 3-dimensional finite element analysis. Int J Oral Maxillofac Implants [Internet]. 2007;22(4):551–62. Available from: http://www.ncbi.nlm.nih.gov/pubmed/17929515

Morris HF, Orenstein IH, Petrazzuolo V. T Heir I Nfluence on S Urvival of. Clin Res. 2004;XXX:145–52.