Internal vs External Implant Connections

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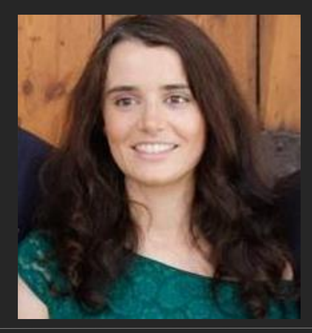

Objectives

The aim of this paper consists of a literature review, whose objective is to describe the differences between implant internal and external connections. The clinical advantages and disadvantages of each connection type will be addressed.

Methods

Research was conducted in the database PubMed/Medline recent literature on the subject, using the words “Dental Implants Connection”; “Prosthodontic Rehabilitation”; "Internal Connection"; "External Connection" and "Internal Connection vs External Connection".
15 articles were selected.

Results

The external hexagon (EH) arose from the hand of Per-Ingvar Branemark, having as main advantages the anti-rotation mechanism, the compatibility with different systems, and the capacity to tolerate a greate degree of divergence between implants when performing a splinted impression - less distortion. [1, 2] However, it disadvantages seemed clear, namely the limited resistance to rotation when subjected to horizontal movements due to the reduced height of the hexagon and the majority of the load being exerted at the interface abutment-implant, which promotes micromovements and consequent loosening, screw fracture, or even bone resorption. [3, 4, 5] According to Tsuge, 2009, the loosening occurs essentially due to occlusal overload or interferences and / or lack of passivity of the structures. [6]

The evolution of implantology led to the development and production of implants with internal connection (IC). According to Santos, 2011, IC presents high mechanical resistance; variety of prosthetic components; transport and installation of the implant with the same key model; intimacy between the inner wall of the implant and the abutment; substantial depth of penetration of the screw; number and shape of anti-rotational grooves; the advantage of the preloaded screw; lower loosening and screw fracture; homogeneous distribution of stress around the implant, reducing bone crest stress; prosthesis-implant fulcrum at the middle third of the implant. The main drawbacks are susceptibility to complications due to overly rigid abutments; impaired print quality; prostheses supported by several implants (mainly cases of non-parallelism) is limited. [7]

In terms of technical complication rates, of IC (follow-up 10 years): Bragger et al. 2005, Gotfredsen 2012, and EH (follow-up 10 years): Jemt et al. 2009: 3-year cumulative annual rate of screw loosening is 5.1 times greater in external connection (95% CI: 1.4-18.6%), with abutment fracture rate being 0% for both and screw fracture 0.1% for EH. [8; 9; 10]

Image 1: EH vs IC [12]

Images 2 and 3: IC and EH[15]

The stress distribution patterns were observed, EH vs IC, for each implant region: IC - higher values in the apical region and in EH - higher values in the first thread and in the cervical region; in the other regions the values found were similar. [11]
It has been observed that in terms of peri-implant stability, IC promotes further stabilization of adjacent soft tissues. [12]
A systematic review of 27 articles with single-unit implants: 12 follow-up articles of 586 EH, between 3 and 5 years 97.3% were free of complications at 3 years; 15 follow-up articles of 1113 IC, between 3 and 10 years, were 97.6% free of complications at 3 years. It can be concluded that in single-unit rehabilitations, there is rarely any unscrewing, irrespective of the geometry of the connection; provided that the correct torque is applied. [13]
In a study by Tsuge in 2008, three types of IC and two of EH were evaluated. Three factors were analyzed: vertical discrepancy; horizontal discrepancy and marginal GAP. For the three factors evaluated, there were no significant differences between the different connections. [6]
In one study with three groups, using 10 implants/group and Procera CAD/CAM abutments with 25º angulation and gold unigrip screws at 32N/Cm; it was tested fatigue. The authors concluded that in implants with greater height of the platform there was greater effect on the loosening; there were no significant values of loosening between groups with or without EH; the presence of EH facilitates placement of the implant and positioning orientation of the abutment; EH does not influence the distribution of forces or resistance to rotation. [14]
Steinebrunner et al. studied four types of IC: 1) Frialit-2, 2)Replace-Select; 3) Camlog and 4) Screw-Vent; and two of EH: 1) Branemark and 2) Compress. The results were: fracture of the prosthetic screw in 50% of 4 implant brands (Branemark, Compress, Screw-Vent and Frialit-2) during dynamic loading; greater longevity and fracture resistance on internal tube-in-tube (Replaceselect) and Cam-Slot (Camlog) connections.[15]

Conclusions

Since the beginning of oral rehabilitation with dental implants, it has been observed the need to develop alternative connection types to meet different prosthetic needs.
Prosthodontic rehabilitation of implants using either internal or external connection is widely used today. The selection of the type of connection depends of a number of clinical characteristics that most adapt to each clinical situation. The dentist knowledge of the advantages and disadvantages of each one is fundamental in order to properly customize each treatment.
The literature reveals that for both types of connection, there is a high predictability of success rates. Biomechanically, advantages and disadvantages are observed in both connections, however the need to develop different types of platforms are recommended.
The choice should be made based on the type of rehabilitation in progress.

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Image References:

Image 1: 12 – Sung-Wook, C. et al, 2015. Complication incidence of two implant systems up to six years: a comparison between internal and external connection implants. J Periodontal Implant Sci. 2015 Feb; 45(1): 23–29.
Images 2 and 3: 15 - Steinebrunner, L. et al, 2008. Implant-abutment interface design affects fatigue and fracture strength of implants clin oral implants res. 2008 DEC; 19 (12): 1276-84.