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Review Article

Internal Vs. External Hexagon Implants: Best Match

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Abstract

Introduction: In the dental implant scenario, success rates are higher than 90.0% after five years of implantation, and about 85.0% after 10 years. The introduction of bone-integrated implants (IOS) was with Branemark in 1981. In this sense, there are platforms with HE and the with internal hexagon (HI).

Objective: Therefore, the present study aimed to point out the main advantages and disadvantages of internal versus external hexagon implants.

Methods: A total of 35 articles were found involving Implants. Internal Hexagon. External hexagon. Best match. Initially, it was held the exclusion existing title and duplications in accordance with the interest described this work. After this process, the summaries were evaluated and a new exclusion was held. The total of 18 articles was evaluated in full, and 15 were included and discussed in

Conclusion: The internal hexagon prosthetic connections are superior to those of the external hexagon because a deeper connection is created with greater contact of the abutment with the internal walls of the implant, reducing the possibility of micromovements.

Keywords: Implants; Internal Hexagon; External Hexagon; Best Match

Introduction

In the dental implant scenario, success rates are higher than 90.0% after five years of implantation, and about 85.0% after 10 years [1]. In this context, if bone overheating, smoking and bruxism are avoided, the success score is increased, being a routine treatment option for correction of total or partial edentulism and as an orthodontic anchorage [1,2].

The introduction of Osseo integrated implants (IOS) was performed with Brandmark in 1981. The authors performed a 15-year longitudinal study in which edentulous mandible implants were installed and the rehabilitation performed with a total met alloplastic prosthesis screwed onto these implants [1]. The system of connection than used was the External Hexagon (HE), on intermediaries called Standard [2].

Thus, for commercially pure titanium IOS in the form of a cylindrical screw allowed insertion into the surgical site by HE. Moreover, this hexagon facilitates the insertion of the implant and is also important for the fixation of the prosthetic components [3]. The IOS platform is the cervical site of the implant that receives the prosthetic component, influencing the mode of transmission of the occlusal forces to the bone. The mismatch between the prosthetic component and the implant platform may lead to treatment failure, mainly due to the induction of stress concentration, bacterial infiltration, and formation of biofilms [3,4].

In this sense, there are platforms with HE and the with internal hexagon (HI) [5]. In this way, HE implants have a great advantage of their simplicity and predictability, with a great variety of prosthetic components and facilitating the choice of the appropriate solution for each case.

Although implants with HE are the most commercialized, they can present limitations, since the height of this implant is limited to 1,0 mm to guarantee the final aesthetics of the implantable prosthesis [6].

Therefore, the present study aimed to point out the main advantages and disadvantages of internal versus external hexagon implants.

Methods

Experimental and clinical studies were included (case reports, retrospective, prospective and randomized trials) with qualitative and / or quantitative analysis. Initially, the key words were determined by searching the Dec's tool (Descriptors in Pub med, Health Sciences, BIREME base) and later verified and validated by MeSh system (Medical Subject Headings, the US National Library of Medicine) in order to achieve consistent search.

Mesh terms

The words were included Implants. Internal Hexagon. External hexagon. Best match. The literature search was conducted through online databases: Pub med, Periodicos.com and Google Scholar. It was stipulated deadline, and the related search covering all available literature on virtual libraries.

Series of articles and eligibility

A total of 35 articles were found involving Implants. Internal Hexagon. External hexagon. Best match. Initially, it was held the exclusion existing title and duplications in accordance with the interest described this work. After this process, the summaries were evaluated and a new exclusion was held. A total of 18 articles were evaluated in full, and 15 were included and discussed in this study.

Literature review

In order to better detail and present the main complications of HE, authors have shown that deformations may occur during implant insertion, requiring great dimensional accuracy to ensure the prosthetic component coupling [1-3]. Moreover, it has the possibility of inducing the concentration of tension in the coronary region and due to the implant-component maladaptation, which facilitates biofilm adhesion at the edge of the implant platform with induction of saucerization [4].

In this sense, the precision of the hexagon dimensions is essential to ensure the stability of the prosthesis, to minimize the loosening of the prosthetic screw, to allow adequate prosthesis seating, to create vertical and horizontal adaptation of the intermediate abutment on the implant platform and to avoid the entrance of bacteria into the internal implant hole [5].

Major considerations on the HE platform

The H platform was implanted without scientific support in implantology. However, its use is still very significant in implantology [6]. Thus, the main advantages that the HE systems offer are appropriate for the two-stage surgical approach; presence of an anti-rotation mechanism; reversibility; compatibility between different systems [6-8].

The main disadvantages are micro-movements due to the low height of the hexagon (0.7mm on average), which can cause screw loosening, pillar loosening, and even screw fracture; a raised center of rotation, which causes less resistance to rotational and lateral movements; micro-cleft between the implant and the abutment, which causes bone resorption around the cervical region of the implant [8].

Major considerations on the HI platform

Literary work has shown that internal hexagon (HI) prosthetic connections are superior to those of external hexagon because it generates a deeper connection and with greater pillar contact with the inner walls of the implant. This reduces the possibility of micromovements during the loads, which allows less stress to the retaining screw [1,9].

Thus, in this scenario, the HI has the objective of improving the adaptation between the hexagons and establishing a more stable interface, increasing resistance and reducing complications, such as loosening or fixation screw fracture [2,10]. In this way, it is possible to emphasize the main advantages such as ease in the abutment of the abutment, suitable for installation approaches in one stage and immediate loading, greater stability and anti-rotation effect due to the greater area of connection between the implant and the abutment, more suitable for unitary restorations, greater resistance and lateral loads due to the more apical rotation center, better distribution of occlusal forces in the adjacent bone [11]. However, the main disadvantages presented by this system are thinner walls around the connection area and difficulties in adjusting angulation divergences between implants [12].

Best match between platforms

HE systems are more susceptible to screw loosening due to their mechanical properties under dynamic loading [12,13]. Internal connection systems are designed to minimize these occurrences. Connections of HI have significant biomechanical advantages over HE connections as well as better distribution of forces under mechanical loading, greater stability due to larger connection area, greater resistance and lateral loads, due to more apical rotation center [13].

However, the HI connections present some disadvantages, such as thinner lateral walls in the connection area, difficulties in adjusting divergent angles between implants and greater rotational freedom. Morse cone connections were developed to improve the biomechanical properties of implant / abutment assemblies and to reduce the incidence of mechanical problems encountered in implant systems with HE and HI [14].

Comparative studies have shown that implants with morse cone connections have higher dynamic and static resistance and superior resistance to screw loosening when compared to HE implants [14,15]. In this sense, authors evaluated the fatigue strength of implants with connections in external hexagon and cone morse, and the comparative analysis showed better results for implants with cone morse connection. Others analyzed by means of a finite element test the micro-movement of the implant / abutment connection in different implant systems. The study compared implants with connections in HE and cone morse, verifying greater micromovimentation and rotation movements in the abutments and complete absence of rotation movements in the cone morse pillars [15-17].

Thus, the HI system appears as an alternative for unitary prostheses. The fact that the internal connection with an antirotational height higher than that of HE would allow better stability, especially when subjected to lateral forces due to mastication [2-4]. Another system that came up with good mechanical properties was the cone morse system. The morse cone connection provides a better distribution of forces throughout the implant when compared to HE. In this sense, when the cone-morse system is compared with the HI system, it is observed that the cone-morse system promotes a lower stress in the peri-implant bone [5-7].

Discussion

Based on the literary findings above, the HE system is appropriate for the two-stage surgical approach, presence of an anti-rotational mechanism, reversibility, compatibility between various systems [2]. The main drawbacks are micro-movements due to the low hexagon height (0.7mm on average), which can cause screw loosening, pillar loosening, and even screw fracture, a high rotation center that causes less resistance to rotational and lateral movements, a micro-cleft between the implant and the abutment, which causes bone resorption around the cervical region of the implant [2,3].

In this context, the prosthetic connections of HI are superior to those of the HE because a deeper connection is created with greater contact of the abutment with the internal walls of the implant, reducing the possibility of micromovements during the loads, which allows less stress to the retaining screw [4].

The cone morse connection presents some advantages over other systems as a better adaptation between the prosthetic component and the implant, eliminating the micro-cleft between the two, which reduced levels of peri-implant bone resorption, better mechanical stability of the abutment, minimizing micro-movements, minimization of micro-movements caused a reduction in the incidence of loosening and screw fractures, better anti-rotational fixation, greater resistance of the implant/ abutment assembly, since the intimate union between the two practically makes its response in mechanics of single body [5-8]. The disadvantages are the absence of an anti-rotational prosthetic positioning mechanism and little familiarity with the system [9,10].

Conclusion

The internal hexagon prosthetic connections are superior to those of the external hexagon because a deeper connection is created with greater contact of the abutment with the internal walls of the implant, reducing the possibility of micromovements.

Conflict of Interests

There is no conflict of interest between authors.

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