



RESEARCH ARTICLE

MAIN PREDICTORS OF BONE CREST PRESERVATION WITH THE USE OF THE SWITCHING PLATFORM.

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Abstract

This study examined the effects of the use of Platform Switching in rehabilitation implantossuportadas. It is a technique that consists in fitting a prosthetic component of smaller diameter the platform of implant with larger diameter, so that there is no combination in the size of both, as in conventional manner. The results showed that the benefits and the indication of the use of this technique is due to reason that the same initial reduces the reabsorption of bone Christian peri-deploy and maintain this level bone in the course of time, as well as reduces the forces on the bone tissue adjacent to the cervical region of the implant. Although there are possible disadvantages in the use of Platform Switching, which may cause an increase of tensions in the region of the screw and prosthetic component, its adaptation in rehabilitation implantossuportadas has been very attractive.

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Introduction:-

Dentistry was favored by the discovery of osseointegration, which became of its importance in the treatment of partially and totally edentulous patients. Initially, osseointegration was only used to treat fully edentulous patients in the maxilla and mandible, through a single type of implant, prosthetic abutment and rehabilitation protocol [1,2]. Surgeons, as soon as they began to use osseointegration, sought only to obtain and maintain the anchorage of the implants, without caring much about aesthetics. However, this has been gradually changed and is now established as a reality, thanks to the longevity of the treatments and to the functional and aesthetic results obtained [2].

Over time, the basic principle of osseointegration has been proven, so as to allow its application in the most varied clinical situations of tooth failure, both unitary and partial. It is necessary that new concepts, principles and technologies be discovered and improved [3]. However, as the applications of osseointegration have evolved, complications have also increased, which have become more numerous and are no longer the result of surgical and mechanical problems of the components of a single care protocol, requiring more research, studies and Care [3].

Among the most varied concerns that prosthodontists experience, peri-implant bone loss is found because a treatment with implants will only have satisfactory results if the soft and hard tissues are maintained in the long term around the implant [2,3] . This led to a reassessment and questioning of the traditional protocols, resulting in new approaches to implantology, among which, the concept of Switching Platform, considered as the use of a prosthetic

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component smaller than the implant platform, In order to reduce reabsorption of vertical bone crest levels around the implants over time [2,3].

Once the prosthesis is definitively installed on the implants, an expected peri-implant bone loss occurs, which is called saucerization [3,4]. This is due to the reestablishment of biological distances. Thus, the application of prosthetic components smaller than the implant platform creates a difference in horizontal adaptation circumference size, limiting bone crest resorption and preserving bone levels around implants [3].

Therefore, Platform Switching consists of a technique adopted to preserve the bone, through the prosthetic connection of a smaller diameter than that of the implant, in order to transfer the existing slit to an innermost position horizontally. Its concept has presented satisfactory results, by reducing peri-implant bone loss through the internalization of the junction between the implant and the prosthetic connection [1-3].

The objective of the present study was to evaluate the effects of the use of the Switching Platform in implant - supported rehabilitations. It is a technique that consists of connecting a smaller diameter prosthetic component to the larger diameter implant platform, so that there is no combination in size of both, as in the conventional form.

Methods:-

For the identification of studies in this review study, carried out a detailed search strategy for Medline, Pubmed, in the years 1986 - 2016. They were used as descriptors: Switching Platform; Regular Platform; Implantology; Implant Supports Rehabilitations. Analyzed studies systematic review, meta-analysis, randomized controlled cases, nonrandomized clinical cases and opinion articles that addressed the term atraumatic surgery. The data are analyzed, correlated to the discussion of the results highlighted in the literature, as shown in figure 1.

Continuous Predictors:-

The continuous predictors were Switching Platform Implant.

Response Predictor:-

The response predictor were increased tensions in the region of the prosthetic component and retention screw, which could lead to loosening and maladjustment and even fracture.

Literature revision:-

Implant concept and Osseointegration:-

The implant is performed when a titanium screw, which can be of various shapes, is inserted into the bone, by means of various surgical techniques. This screw will support a prosthetic crown, which can be cemented or screwed, which will restore the functions of the natural tooth crown [40].

When analyzing the blood microcirculation in rabbit tibia in the 1960s, Branemark verified that there was a perfect integration of the bone with the titanium used in the research, which led to the appearance of the term osseointegration, that is, structural and functional junction that occurs Between the living, ordered bone and the surface of the implant submitted to the functional load [6].

In this context, it is not only the osseointegration that Branemark discovered that it is enough for an implant to be successful, also needing other factors, among them, a correct occlusion, that is, a harmonic relationship between the upper and lower arches without nothing interfering. If there is no such occlusal harmony, occlusal trauma or premature contact may occur, which may lead to changes in the functioning of the masticatory apparatus, significantly altering the position of the teeth, gingival recessions, bone resorption, as well as interfering with the implants installed, generating undesired results. Patient and the surgeon [43].

Bone Loss:-

In implants where the heights of the structures are greater than 180 μm , even if there was no inflammation in the peri-implant tissue, an increase in bone resorption may occur due to occlusal overload [35]. This is because bone resorption is generated where there is an inflammatory reaction or a prolonged excessive stimulus [6,16].

However, in the first implants performed, there was correspondence between the prosthetic components, observing the occurrence of an apical remodeling of the bone crest of about 1.5 to 2.0 mm of the implant implant pillar or at the level of the first thread, the Which altered the successful results of implant maintenance [5,27].

This bone loss was defined as saucerization, which consists of a process that affects all types of osseointegrated implants, regardless of even the general conditions of the patient. It is a mechanism of adaptation of the organism in the establishment of the physiological dimensions of the periodontium, that is, of the periodontal biological space. This process of saucerization occurs mainly around external hexagon type implants [1,2].

The Peri-implant junctional epithelium is shown to have more layers of cells, assuming a conformation very similar to the junctional epithelium of the natural teeth, which approximates the Peri-implant junctional epithelium of the osseointegrated surface, increasing the concentration of Gingival connective tissue at the site, represented by the arrows and, consequently, accelerating bone resorption, beginning the saucerization [2].

In conventional implants, the apical remodeling of the bone crest occurred when exposed to the buccal medium after a healing was performed or the second stage surgery performed. This is due to the fact that an inflammatory infiltrate arises in the implant interface pillar implant or the attempt of the soft tissue to create a barrier, in order to seal the environment of the implant platform [11,16]. However, bone resorption can also be induced by stress concentrations in the coronal region of the implant [16,19].

Many factors may lead to loss of bone crest around conventional implants, among which the most common are: surgical trauma, recovery of biological space, occlusal overload, peri-implantite, gaps [23], as well as manipulations Tissues [11]. Some consequences can be caused by the resorption of the bone crest around dental implants, especially in relation to aesthetics, because the soft tissues change in the proximal faces, which can be seen in the papillae and, on the vestibular face, through the Presence of recessions [16,23].

Keeping the level of the bone crest in the ridge of implants was only possible when, occasionally, a radiographic study was able to make this observation. This is due to the fact that the Implantodontics company, called Innovations 3i, has introduced wide-diameter platform implants (5.0 mm and 6.0 mm), which should be used in cases of implants failure Standard and poor bone region [2,3]. Above all, because there were no prosthetic components corresponding to these implants, they were restored with 4.1 mm abutments, so that a step of 0.45 mm occurred and, radiographically, a variation of 0.45 mm at 0.95 mm [32].

After 13 years of follow-up, by means of radiographs, these restored restorations with smaller diameter pillars than the platform, it was possible to verify that the levels of bone crest were maintained with minimal marginal bone loss, thus raising the concept Of Platform Switching [16].

Platform Switching:-

The concept of Switching Platform used in rehabilitation with osseointegrated implants has been increasingly used, both in the literature and in implant clinics, because it presents satisfactory results, both aesthetic and functional. This is a concept created by Lazzara and Porter (2006) [32], which consists of the use of a smaller diameter prosthetic component connected to the platform of a larger diameter implant, in order to create a "step" of 90 Between the implant and the prosthetic component.

Although a number of factors influence bone resorption, many studies show that implants with a Switching Platform system are more advantageous in relation to implants in which there is a combination of the standard prosthetic component with the type of implant, to maintain the crest level Because it improves the results of peri-implant soft and hard tissues, maintenance of the position of the interdental papilla and marginal gingiva, in addition, when using a prosthetic component of smaller size, the concentration of force area on the implant occurs of the marginal bone crest area. [8,37].

The Switching Platform has been considered a very significant form of treatment to maintain soft and hard peri-implant tissues, not only in two-stage implants, but also in immediate-loading immediate implant protocols. This system removes the concentration of stresses from the peri-implant bone margin and reduces its effect on marginal bone resorption [30]. There is a chain of theorists who affirm that the occurrence of change in the prosthetic-implant

component connection contributes to the maintenance of the biological space, thus reducing bone loss of the marginal ridge [32,37].

Based on Maeda et al. (2007) [34] verified the biomechanical advantages of the Switching Platform, analyzing three-dimensional finite elements, through the use of an external hexagon-type implant model (4.0 mm x 15 mm), on which two types of implants were performed: One with a prosthetic component of 4.0 mm in diameter and the other with a prosthetic component of 3.25 mm, using the Switching Platform configuration.

According to Canullo et al. (2010) [18] developed a study to evaluate changes in bone level in implants with Switching Platform system, making use of various combinations between implant / prosthetic component. After 90 days, they verified that the connection of the prosthetic components of 3.8 mm to the implants occurred, and the restorations were definitively installed. The bone was measured by radiographs performed at implant placement (control), and after 9, 15, 21 and 33 months. After 21 months, all implants were clinically osseointegrated in all 31 patients studied. However, according to the radiographs, the authors verified the occurrence of bone loss of 0.99 mm (± 0.42 mm) for Second experimental group; 0.82 mm (± 0.36 mm) for the third experimental group and 0.56 mm (± 0.31 mm) for the fourth experimental group. However, these values were lower in comparison with the control group (1.49 mm ± 0.54 mm). After 33 months, no difference was found compared to the 21-month results, with the exception of the third experimental group (0.87 mm) and the fourth experimental group (0.64 mm), leading to the conclusion that the existing relationship is Inverse relationship between size / extent of implant-prosthetic component decompensation and amount of bone loss, with the maintenance of better bone margins levels using the Switching Platform configuration.

The study by Calvo-Guirado et al. (2009) [17] evaluated the survival rate of implants made in the maxilla, anterior and premolar areas and restored with single crowns after one year and also loss of bone crest. In this study, implants were fixed in the alveoli, after tooth extraction, with an immediate temporary restoration, and the definitive implant was placed after 15 days, through the Switching Platform concept.

Still in the same year of 2009, Schrottenboer et al. (2009) [42], studying the interaction of the platform in the transcortical section of the adjacent bone of an osseointegrated dental implant, developed a two-dimensional model to analyze finite elements in order to observe the bone-implant interactions under mastication forces. They simulated, together with a 5.0 mm diameter implant, two prosthetic components, one of 4.5 mm in diameter, to represent the switching platform and the other 5.0 mm, to represent a standard diameter platform, Applying static forces of 100 N, vertically (90°) and obliquely (15°) on the pillars. The results revealed that with the standard platform model, the maximum von Mises stress pressure on the bone crest was 28 MPa under oblique load and 6,977 MPa under vertical load.

Hsu et al. (2009) [29] when checking the bone tension and micro-movement at the bone-implant interface for switching platform, simulated finite elements and analysis by extensometry with different diameters of a single implant with immediate loading. They created four models, 5.0 mm diameter implants with prosthetic components 5.0 mm and 4.0 mm in diameter, cemented (late loading) and screwed (immediate loading), and a model with implant of 3.75 Mm diameter, in which vertical and lateral loads of 130 N were applied, which resulted in the following: bone forces were reduced by up to 10% with the use of the switching platform.

Another evaluation of bone crest alterations was made by Vigolo et al. (2009) [47], who did so for a long period of five years, after implanting external hexagon type 5.0 mm diameter restoration with components of the same diameter or switching platform. One group had mean bone resorption values of 0.9 mm (± 0.3 mm), while the other group had 0.6 mm (± 0.2 mm). In consecutive years no marginal bone resorption was observed, leading to the conclusion that restored implants with prosthetic components of standard diameters had greater bone loss than those restored with a switching platform.

Cocchetto et al. (2010) [22] sought to verify that the change of the junction to a more interior region of the implant platform may result in less resorption of the bone crest, with an increase in the discrepancy between the implant platform and the prosthetic component diameter. This study was performed with 10 patients who needed restoration with mandibular or maxillary implants. Fifteen 5.0 mm diameter implants with a switching platform with a diameter of 5.8 mm in the collar were used, and 5.0 mm prosthetic surfaces were attached, which were connected to healing wounds of 4.1 Mm for eight weeks, following single-stage protocol. The results showed a peri-implant bone loss averaging 0.30 mm.

Bilhan et al. (2010) [13] performed a study with 51 patients to compare bone preservation around regular implants and switching platform that supported overdentures. A total of 126 implants were performed, with follow-up for 6, 12, 24 and 36 months after the installation of the prostheses. Through a series of radiographs they were able to show that, with the use of the switching platform, there were lower bone and distal bone losses in 36 months, although there were differences in mesial and distal surface loss in both groups. They verified, therefore, that the smaller bone losses in implants that support overdentures occur with the use of platform switching.

Chang et al. (2010) [21] performed an analysis and comparison of tensions at the bone-implant interface with protein elements of standard diameters and diameters according to the concept of switching platform in the posterior maxilla region, using finite elements. They created two finite element models, one of a first maxillary molar section, with an osseointegrated implant of 4.1 mm x 10.0 mm, with the simulation of a prosthetic component of 4.1 mm in diameter and another model with a little narrower component, that is, with 3.4 mm, simulating the switching platform.

Fickl et al. (2010) [24] studied the influence of the use of the switching platform at the height of the bone crest around dental implants in 89 dental implants and 36 patients. For this, these authors observed implants made in healthy bone, which did not require an increase of ridge. In this way, they created the following: Group 1, with the placement of wide diameter implants in the region below the bony crest and the connection of regular diameter scars; Group 2, placement of regular diameter implants on the ridge line and connection of regular diameter scars. The results showed that, with the use of the switching platform system (n = 75), bone loss was significantly lower at the moment of definitive insertion of the prosthesis (0.30 ± 0.07 mm, versus 0.68 ± 0.17 mm; $p < 0.05$), and in one year (0.39 ± 0.07 mm versus 1.00 ± 0.22 mm, $p < 0.01$), compared with conventional implants (n = 14), leading them to conclude that implants With switching platform limit bone crest remodeling.

Discussion:-

For Lazzara and Porter (2006) [32] the term Switching Platform has been extensively studied in Implantology today, which means that the base of the restorative abutment is smaller than the head of the implant where it is embedded. An implant performed according to the Switching Platform concept presents, around the cervical region, a greater quantity of soft tissues and maintenance of more bone, because of the reduction of the remodeling generated by the establishment of the biological space.

The ideal for the success of an implant would be minimal or no bone loss, however, there is always some bone loss, especially after one year of masticatory function [28]. Several biological and mechanical factors influence this resorption around the implant, such as bacterial microleakage, localization of inflammatory connective tissue area, concentration of stresses in the cervical region of the implant, location of the implant / abutment junction and micro-movements [38].

The maintenance of the bone / implant interface, whether biomechanically, in the induction of stresses, or biological, depends on the type of connection that can allow bacterial infiltration at the interface, which directly influences the success of the rehabilitation. [14,20,46]. This fact is evidenced, especially, in the alteration of the height of the bone crest, as a consequence of the concentration of tension in the cervical region of the implant [21]. Thus, the implant system must be designed to better dissipate the load in the peri-implant bone, so that it can support restoration in function and maintaining osseointegration [48]. In view of this, some studies have shown that resorption of bone crest can be reduced by the use of the Switching Platform technique [32,38].

The rehabilitations that make use of the concept of Switching Platform have been much studied, aiming to verify their real advantages and disadvantages in the short and long term. Among the advantages, the literature points to the reduction of reabsorption of the peri-implant bone crest, as verified by the following authors: Calvo-Guirado et al. (2009) [17], which evidenced a reduction in bone loss in osseointegrated implants with the use of the Platform Switching concept; Canullo et al. (2010) [18] who, in an evaluation of sixty implants, observed the occurrence of an inverse relationship between the extent of implant-prosthetic component decompensation with amount of bone loss, so that the greater the discrepancy, the lower the loss Bone at the peri-implant crest, still acting on the longitudinal maintenance of this bone level. Also Cocchetto et al. (2010) [22] and Bilhan et al. (2010) [13], have concluded that increased discrepancy between implant and prosthetic component reduces subsequent bone loss.

In relation to the distribution of forces under occlusal loads, Schrotenboer et al. (2009) [42] observed that the Switching Platform system for the Von Mises test, on cortical bone crest, had a measurable but minimal effect. Hsu et al. (2009) [29], when using finite elements in their studies, concluded that there is a 10% reduction in forces exerted on bone when there is the use of the Switching Platform concept in relation to conventional implants and that the increase of implant diameter (Extended platform) led to an expressive reduction of the stress in the surrounding bone to the implant, leading to understand that not only the Switching Platform system, but the increased implant diameter reduces stress in the bone tissue. Still in the same study, they stated that none of the settings used. However, regarding micromovements to improve the stability of the implant, no differences were identified when comparing with those presenting conventional implants.

In relation to stress concentration, Chang et al. (2010) [21], found that the Switching Platform system led to a reduction of stress concentration in areas of compact bone but transferred this concentration to areas of spongy bone. Also Tabata et al. (2011) [45] have shown that implants with Switching Platform are advantageous in terms of improving biomechanical stress distributions in peri-implant bone tissue.

However, Maeda et al. (2007) [34] concluded that although the Switching Platform system shifts to more distal from the cervical stress area concentration, which has been considered as important for maintaining the peri-implant bone crest, it generates an increase in stress on the component Prosthetic and retaining screw, which may lead to maladjustment, fracture or loosening of the screw. In addition, according to Vigolo and Givani (2009) [47], the 85 implants from his work in which wide platform components were used showed greater bone loss than the 97 implants in which the switching platform was used in the components.

Through statistical analysis of 850 implants with switching platform and the evaluation of radiographic changes of marginal bone levels and their amount of loss compared to implants without switching platform. The results showed that the implants with switching platform lost less marginal bone in relation to the rehabilitated ones without platform switching, except for the study of Kielbassa et al. [50] where decreasing the size of the component relative to the platform resulted in a loss of 0.8mm. This bone loss was greater than the conventional rehabilitated implants, where a loss of 0.63 mm was detected.

Figure 1:-

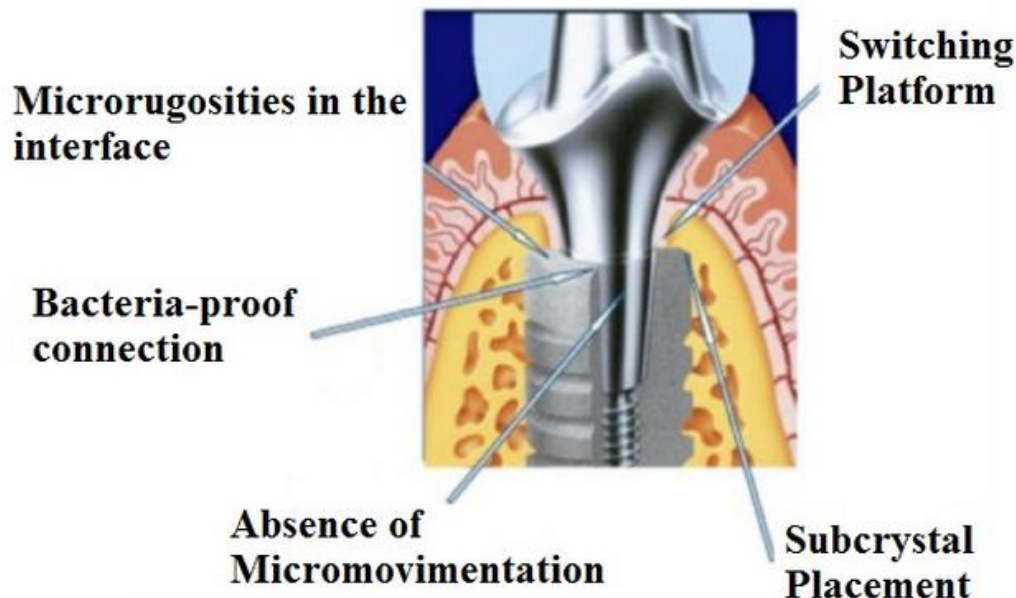
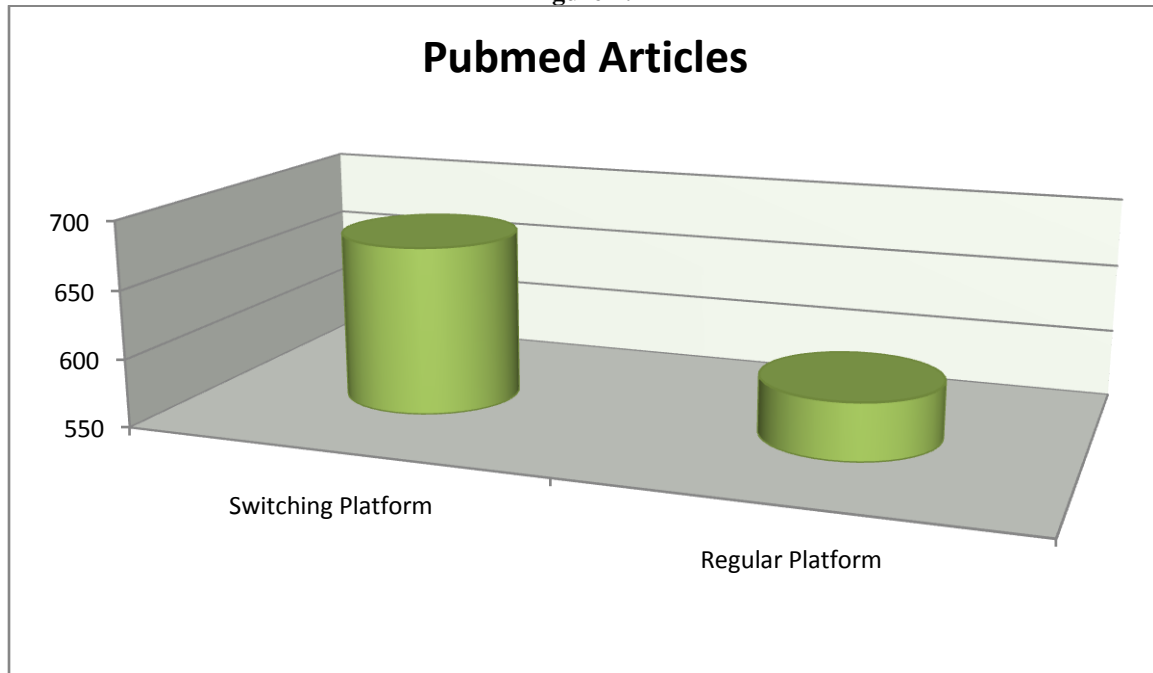


Figure 2:-



Conclusion:-

The biological advantages and the clinical performance of the Switching Platform technique in the implant-supported rehabilitations were evaluated, reducing the bone resorption at the marginal ridge adjacent to the implant with the maintenance of the implant, as well as a reduction of about 10% in the forces on the bone tissue. However, the use of this technique can increase tensions in the region of the prosthetic component and retention screw, which can lead to loosening and maladjustment or even fracture.

Competing Interests:-

The authors declare no competing interests.

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