



GRADUATION PROJECT

Degree in Dentistry

ONE ABUTMENT – ONE TIME. SYSTEMATIC REVIEW.

Madrid, academic year 2025/2026

RESUMEN

Introducción: La colocación de un implante dental y la inserción inmediata del pilar definitivo siguiendo el concepto one abutment-one time (OAOT), se ha propuesto para limitar las múltiples desconexiones y reconexiones del pilar, lo que podría ayudar a preservar los tejidos peri-implantares; **Objetivos:** Esta revisión analiza y compara el efecto del protocolo OAOT con el protocolo convencional enfocado en la pérdida marginal de hueso alrededor de los implantes dentales; **Metodología:** La cuestión de esta investigación fue “¿En pacientes en rehabilitación con implantes dentales, el protocolo OAOT, comparado con el protocolo convencional, reduce en mayor medida la pérdida ósea periimplantaria?”. En esta revisión se utilizó el diagrama de flujo PRISMA. Se realizó una revisión sistemática incluyendo un total de 10 estudios clínicos aleatorizados (RTs), publicados en inglés en los últimos 10 años, evaluando los cambios del hueso marginal con un seguimiento de al menos 12 meses. Cada estudio compara el protocolo OAOT con el protocolo convencional. Se realizó el análisis del riesgo de sesgo (RoB2, Método de Cochrane) para analizar la validez de los estudios incluidos; **Resultados:** El protocolo OAOT no muestra una diferencia estadísticamente significativa en la pérdida marginal del hueso en comparación con el protocolo convencional; **Conclusiones:** El protocolo OAOT y el protocolo convencional resultan igual en la pérdida marginal del hueso. Sin embargo, se encontró una mayor estabilidad del tejido blando peri-implantar y una mejor adaptación de la mucosa alrededor del implante dental en el grupo de pilar definitivo siguiendo el protocolo OAOT.

PALABRAS CLAVE

Odontología, implante dental, one abutment-one time, platform switching, pérdida ósea marginal.

ABSTRACT

Introduction: The placement of dental implant and the immediate insertion of definitive abutment following the one abutment-one time (OAOT) concept has been suggested to limit multiple abutment disconnections and reconnections, which could help preserve the peri-implant tissues; **Objectives:** This review analyze and compare the effect of the OAOT protocol with the conventional protocol focused on the marginal bone loss around dental implants; **Methods:** The question of this investigation was “In patients undergoing dental implant rehabilitation, does the one abutment-one time protocol compared with the conventional protocol, result in a greater reduction in peri-implant bone loss?”. A systematic review was conducted, using the PRISMA diagram flow, including a total of 10 randomized clinical trial studies (RCTs), published in English language in the last 10 years. The changes of marginal bone are evaluating with a follow up of minimum 12 months after implant placement. Each study compares the OAOT protocol vs conventional protocol. The risk of bias (RoB2, Cochrane Methods) was performed to analyze the validity of the studies included; **Results:** The OAOT protocol does not show a statistically significance difference in marginal bone loss compared to the conventional protocol; **Conclusions:** The OAOT protocol result equality to conventional protocol in marginal bone loss. But more peri-implant soft tissue stability and better adaptation of mucosa around dental implant was establish in definitive abutment group following OAOT protocol.

KEYWORDS

Dentistry, dental implant, one abutment-one time, platform switching, marginal bone loss.

ABBREVIATIONS

OAOT: one abutment – one time

MBL: marginal bone loss

CBCT: cone beam computer tomography

CAD-CAM: computer-aided design and computer-aided manufacturing

DEF: definitive abutment

HEA: healing abutment

DIB: distance implant-shoulder to first visible bone-to-implant contact

SD: standard deviation

TG: test group

CG: control group

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1. INTRODUCTION

Nowadays, the use of dental implants extends beyond the traditional prosthetic approach to the rehabilitation of edentulous areas. It is increasingly being seen as part of a broader concept that encompasses not only oral health, but also aesthetic and personal image, reflecting the growing emphasis on appearance and self-presentation in modern society (1). Dental implants offers superior outcomes in terms of function, comfort and esthetics, compared to traditional restorative treatments (such as dentures, bridges and crowns) (1). They can replace, single or multiple missing teeth in a fixed way by mimicking the root of natural teeth, thus allowing the recovery of normal chewing, swallowing, speaking functions and smiling. Implant-supported prosthesis is formed by a dental implant inserted into the patient's maxillary bone or mandibular bone, which is linked to the prosthetic restoration by an implant abutment (2,3). In terms of biocompatibility, due to its excellent mechanical and chemical properties, titanium is the elected material for intraosseous implants. It promotes a strong biological connection between the implant and the bone, thereby reducing the risk of adverse reactions from the human body (4,5). Following the surgery of implant placement, the surrounding living bone and the implant surface come into contact, creating a functional and structural connection, that concludes approximately 3 to 6 months after the implant placement; a process which was first described by Per-Ingvar Brånemark, also known as osseointegration (6,7). To achieve optimal functional outcomes and long-term success, a systematic process is necessary: starting with a complete and precise assessment of the patient's oral characteristics, followed by a case evaluation and patient expectations, and concluding with the development of a treatment plan and protocol that improve therapeutic efficacy and prolong the patient's health. In synthesis, dental implant success is influenced by both implant design and patient-related factors (including systemic health status and bone characteristics) (8). Moreover, regarding the clinical protocol, speaking of implant abutment, there are two protocols for abutment management that can affect the long-term stability of implant: the conventional multi-connections approach and the one abutment – one time (OAOT) protocol. Nowadays, the OAOT protocol is widely used, limiting of repeated disconnection of the abutment, thus minimizing disturbances on soft tissue and hard tissue (9). Two concepts are linked to the abutment clinical protocols: the platform-switching and the platform matching have an effect on the different positioning of the implant-abutment interface. The OAOT protocol can incorporate the platform switching concept, in which the abutment is narrower than the implant platform, which will lead to the formation of a stable biological seal with the surrounding soft tissues (10,11).

1.1. Factors affecting the success of dental implants:

According to several studies, the ten-years survival rate of dental implants can reach 90%, although the outcome can be influenced by the surgery protocol, the characteristics of the dental implant (surface treatments, length, width and geometry), the loading protocol (conventional or immediate), the abutment placement protocol (traditional protocol, with multiple disconnection of the abutment or OAOT protocol, without any disconnection of the abutment), the implant-abutment interface, the implant-abutment connection (internal hexagon, external hexagon) and the type of prosthetic restoration (12–15). Dental implants, throughout the entire clinical procedure, are exposed to various biological, mechanical and chemical factors that may, in some cases, lead to implant failure. Several risk factors can compromise the long-term success of dental implants, with biological and mechanical factors being the most common (8,16).

1.1.1. Biological factors:

Factors related to the patient such as age, medical status, oral care, bone quality and bone quantity, can affect the biological process of the osseointegration: vascularization, remodeling of the bone, healing of soft tissues, infections due to bacterial infiltration. All of the above mentioned factors may lead to implant failure (17). According to the time of appearance, the implant failure can be early, resulting from the inability to develop the osseointegration process, due to the presence of gap between implant and surrounding structures after tooth extraction; or the implant failure can be late, due to the incapacity of maintenance of the osseointegration process, such as the inflammatory reaction, also known as peri-implantitis (7). While biological factors are an important variable to investigate, mechanical factors such as distribution of load around the implant also be considered.

1.1.2. Mechanical factors:

The distribution of the load tolerate to the implant-supported prosthesis is lower than the natural tooth. Structure – related factors such as the implant size, the loading time and the type of connection implant-abutment, can increase the stress over the alveolar bone causing a bone loss in the marginal area, which may impair the function of the dental implant (18). If the environment of peri-implant tissue is compromised, due to various biological and/or mechanical

factors, it can lead to alterations such as bone resorption, apical mucosal recession, thus jeopardizing the stability of the dental implant (19). The establishment and the functionality of the dental implant depends on the peri-implant tissues.

1.2. Peri-implant tissues:

1.2.1. Periodontal ligament:

The periodontal ligament supports the natural tooth through its attachment to the root cementum. This structural arrangement differs in dental implants, where the absence of root cementum and periodontal ligament leads to a direct connection between the implant surface and the surrounding bone, which consecutively influences bone remodeling and alveolar bone density (20). In dental implants, the connective tissue fibers, originating from the junctional epithelium, are arranged in a circular pattern around the abutment and the platform of the implant (**Figure 1**).

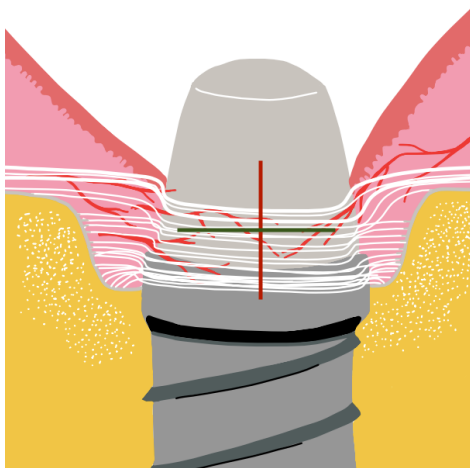


Figure 1. Arrangement of periodontal fibers in peri-implant tissue, around the dental implant in circular pattern. The green line represent the cross section cut, and the red line represent the long axis cut (image handmade by me, inspired to the article) (21).

Longitudinally, the fibers run parallel to the long axis of the implant, while in cross section, they appear circumferentially oriented around the abutment. Thanks to this type of fiber arrangement the stabilization of peri-implant tissue is maximized, apical migration of soft tissue is delayed, and the bone is protected to the early bone resorption (21).

1.2.2. Peri-implant mucosa:

The peri-implant soft tissue, composed of connective tissue and epithelium, is essential, as represents the first line of protection against bacterial invasion (22). Certain level of mucosa, approximately 3mm to 4mm, surrounding the transmucosal component of dental implant, are

considered a prerequisite for achieving a proper biological seal and a stable healing process (23,24). From a clinical perspective, the gingival biotype also has a major impact on the stability of peri-implant tissue; a thick biotype reduces the risk of occurrence of inflammation, as the appearance of peri-implantitis. A stable peri-implant soft tissue is associated with a better preservation of the bone structure supporting the dental implant (21). From this, it is evident that maintaining an healthy mucosa is fundamental to prevent any possible future resorption processes, which in the long run, may influence the longevity of dental implants.

1.2.3. Peri-implant bone:

The quality and quantity of the patient's jawbone must be carefully evaluated to ensure the proper implant placement and the most appropriate future prosthetic restoration. Nowadays, to access bone volume and morphology, the cone beam computer tomography (CBCT) is widely used, thus generating a three-dimensional volumetric data. This type of technology allows to study specifically the case's information such as the 3D image of patient's bone, the soft tissues, nerve paths and teeth; at last but not least, it permits us a better control over the region of interest during dental implant planning and surgery (25,26).

The factors involved in marginal bone loss, are not only related to the peri-implant soft tissue, but are also related to implant length, implant depth, implant-abutment interface (depending on the use of abutment matching or platform switching), insertion torque of implant, abutment macrogeometry (including height, shape (conical, straight, concave) and diameter), occlusal overloading and peri-implant diseases.

1.3. Platform switching:

In the last 40 years, platform switching has rapidly become a major subject of implant research and is currently regarded as a key factor in the prevention of early peri-implant bone loss (27). In the past, the diameter of implant platform matched with the diameter of abutment, while nowadays with the concept of platform switching the abutment diameter is one size smaller respect to the platform of the implant (28,29). Several studies have examined the advantages and clinical benefits of platform switching, showing that implants with a platform-switching design helps in reducing crestal bone loss, compared to platform-matching ones (29,30).

The platform-switching design has a positive influence on peri-implant soft tissue, increasing their thickness and sealing capacity. This configuration creates a horizontal step that shift the implant-abutment interface towards the central axis of implant, moving it mesially to the vertical primary implant-bone contact. This displacement promotes a more coronal connective tissue attachment and helps to maintain the crestal bone height, acting as a protective mechanism, by shifting the cell infiltrate inwards and away from the crestal bone (21,31,32). In mechanical terms, platform-switching allows the redistribution of occlusal forces from the bone-implant interface to the central axis of implant, although it may result in increased stress on the abutment (31).

The combination of platform-switching concept and the one abutment – one time protocol maximized the biological benefits in terms of preserving peri-implant stability.

1.4. One abutment – One time (OAOT):

OAOT protocol technique differs from the traditional protocol in the timing of the abutment placement (the transmucosal component). In this protocol the abutment placement happens at the same time of implant placement surgery (33). In the traditional two step protocol, a healing abutment is placed at the time of the surgery, then after the first healing period, approximately three to four months, it is replaced by a definitive one. This means that during all clinical protocol, starting with implant placement and ending with screwing/cementation of definitive prosthetic restoration, the abutment will be disconnected and reconnected to allow the different phases of prosthesis workflow, such as the impression phase and the final restoration placement phase.

OAOT concept uses an immediately definitive abutment, avoiding the multiple solicitations toward soft tissue, ensuring a long-term stability and safety of hard and soft tissues (10,33). Therefore, peri-implant soft tissue and hard tissue plays a fundamental role in the long-term stability and in the protection of the implant from a high contaminated environment. In other words, both osseointegration and biological seal are essentials for implant success (10,33,34).

1.4.1. Biological mechanisms for bone preservation:

This protocol, in which the definitive abutment is placed during the initial surgical stage and is not subsequently removed, allows the peri-implant mucosa to shape and adapt around it,

promoting a more natural and harmonious soft tissue architecture. Consequently, the absence of a healthy and stable mucosa during the early healing phase can lead to the development of peri-implant pathologies, potentially resulting in implant failure (10,33). Several studies have highlighted that repeated abutment removal disrupts the integrity of the epithelial and connective tissue seal, leading to micro-movements and bacterial penetration that can accelerate peri-implant bone resorption. For that, greater mucosa thickness is associated with enhanced preservation of the underlying bone, a condition that is favored by the immediate and definitive placement of the abutment (21,33).

From a biological standpoint, when the OAOT protocol is combined with the platform-switching design (which provides space for the formation of connective tissue fibers in a more coronal direction and increases soft tissue thickness) the clinical outcome is optimized and simplified, decreasing the inflammatory and mechanical stress around the implant-abutment interface (21,35). In this protocol, the provisional restoration is placed directly onto the definitive abutment, either with or without functional loading, allowing the peri-implant tissues to heal and mature naturally around the final emergence profile. This approach not only simplifies the prosthetic workflow but also improves soft tissue adaptation and aesthetic results.

1.5. Digital workflow and CAD-CAM abutment:

During the planning phase, cone beam computer tomography (CBCT) allows the clinician to select ideal shape and size of the dental implant, while also studying its position directly within the patient jawbone using a three-dimensional simulation.

The fully digital workflow enhances the personalization of each step of the dental implant protocol, from initial diagnosis and digital planning, through guided surgery, to the fabrication of customized abutment with computer-aided design and computer-aided manufacturing (CAD-CAM) technology, and finally the prosthetic restoration. This digital integration enables the entire treatment to be planned before the surgical appointment, improving both efficacy and accuracy (36). The use of CAD-CAM in manufactured definitive abutment, plays a crucial role combined to OAOT protocol. These abutments are designed based on the 3D virtual model of patient's mouth, creating with specific information on the anatomy and specific implant position, thus ensuring a precise emergence profile, optimal soft tissue support, and ideal load distribution; maximized precision and predictability (37). Clinically, the customization of definitive abutment by CAD-CAM, results more favorable for the soft tissue being design for the

specific case, respect to conventional healing abutment, resulting also better in aesthetic outcomes and with greater long-term stability. The adaptation of peri-implant soft tissues around the abutment from the first moment, and which are no longer modified is the fundamental principle. Additionally, at the same time as the design of the definitive abutment, the CAD-CAM system allows for the creation of a provisional restoration, positioned immediately after the placement of the abutment (38,39).

2. OBJECTIVE

This review aims to clarify the current evidence regarding the biological and mechanical behavior of the one abutment-one time (OAOT) approach, providing a comprehensive understanding of its effectiveness and of the conditions under which it may be beneficial in reducing marginal bone loss, compared with the conventional abutment protocol. In the context of modern implant prosthodontics, the OAOT protocol has been proposed as a strategy to simplify clinical procedures, reduce treatment time, and improve both functional and aesthetic outcomes, thereby increasing treatment predictability. The reason for conducting this study is to analyze the clinical outcomes of the OAOT protocol, in which marginal bone loss over the time is reduced by avoiding repeated abutment disconnection and reconnection. However, the results reported in the literature vary, as multiple factors related to abutment design, such as CAD-CAM customization, geometrical shape, platform-switching or matching connection, may influence peri-implant bone preservation.

The **first objective** of this research is to evaluate and analyze the efficacy of the “one abutment-one time” technique in reducing peri-implant bone loss in the following 1-5 years after dental implant placement, compared to the conventional protocol in which repeated abutment disconnection and reconnection may compromise the stability of peri-implant soft and hard tissues. Furthermore, this study aims to identify the influencing factors related to the abutment characteristics and their role in peri-implant bone preservation. The analysis focuses on the combined effect of the OAOT protocol and the platform switching design in minimizing marginal bone loss.

Taking these objectives into account, the **null hypothesis** of this systematic review would be “marginal bone loss does not differ between dental implant restored with the conventional abutment protocol and those rehabilitated with OAOT protocol”.

This research is conducted through a systematic review of the current literature and aim to contribute to improving long-term implant stability and clinical outcome.

3. MATERIAL AND METHODS

This systemic review was conducted to analyze information on the OAOT protocol of dental implant, based on the crestal bone resorption effect. The databases used for this research was PubMed due to their relevance in biomedical and dental research. Keywords used were like dental implants, peri-implant tissues, one abutment one time protocol, repeated abutment disconnection, platform switching, marginal bone loss; combined to the Boolean operators as AND, OR and NOT to specify the search results.

The articles were selected manually after careful evaluation. The filters were applied to include only English-language publications, and to include articles exclusively published in the last decade, to ensure that the evidence reflects the most current scientific knowledge.

The definitive research of this systematic review was done used PubMed database, with a specific keyword: (((dental implant) AND (one time abutment)) OR (repeated abutment disconnection)) OR (crestal bone resorption). The filters applied for the research are the “publication date” included the articles publicized in the last 10 years, and the “article type” included only the randomized controlled trial articles.

The documents resulting from the search were evaluated by a methodical strategy to identify relevant studies to include in this study. First evaluation was based on the title and abstract of the articles, to assess the relevance. Then, the verification of full-text availability is being conducted, to continue with the analysis of the full-text document of the selected studies, according to the predefined inclusion and exclusion criteria, to ensure a high-quality research and coherence in the article selected.

Based on the selected database, the research question was elaborated by the PICO framework (Population, Intervention, Comparison, Outcome), which guided the development of the search strategy. Subsequently, inclusion and exclusion criteria were applied to ensure a validity, coherence and methodological rigor of the systematic review.

3.1. Pico question:

The research is guided by the following PICO question: in patient using dental implant for rehabilitation of edentulous area, how “one abutment-one time” protocol compared to conventional protocol is more effective preserving marginal bone level and establishing a stable peri-implant environment, increasing implant longevity.

- P (Population): Patient receiving rehabilitation using dental implants
- I (Intervention): Use of “one abutment-one time” technique
- C (Comparison): Use of conventional protocol
- O (Outcome): Reduction of peri-implant bone loss, contributing to maintains peri-implant marginal level, enhances soft tissue and hard tissue stability in long-term.

3.2. Inclusion criteria:

- Articles that include a comparison between the conventional protocol and the “one abutment- one time” technique.
- Articles that monitor the one abutment-one time protocol for more than 1 year after implant placement.
- Studies focusing on the measurement of marginal bone loss using the one abutment-one time protocol.

3.3. Exclusion criteria:

- Studies published more than 10 years ago.
- Articles that evaluate marginal bone loss without using a specific imaging system, such as X-ray system or CBCT.
- Articles including case report or case control studies.
- Systematic review articles.

4. RESULTS

The definitive Boolean equation “(((dental implant) AND (one abutment time)) OR (repeated abutment disconnection)) OR (crestal bone resorption)”, resulted in a total of 2065 articles in

relation with the one abutment - one time (OAOT) concept. The application of the year filter “last 10 years” and the article type “randomized clinical trial” are applied and resulted in a total of 172 articles. After reading the title and the abstract 159 articles have been excluded and the rest 13 articles have been selected. Then, 2 articles have been excluded due to not availability of full text. After reading the full text of the remaining 11 articles elected for eligibility, 1 article was excluded because in the studies was evaluated the follow up at 6 months, for that this study not respect inclusion and exclusion criteria of the systemic review (40). The research end with the inclusion of 10 articles (**Figure 2**). The articles included in the review are English-language, publicized in the last 10 years, and only randomized clinical trial (RCT) studies. The process used for the election of included articles in this systematic review was the PRISMA flow diagram (41).

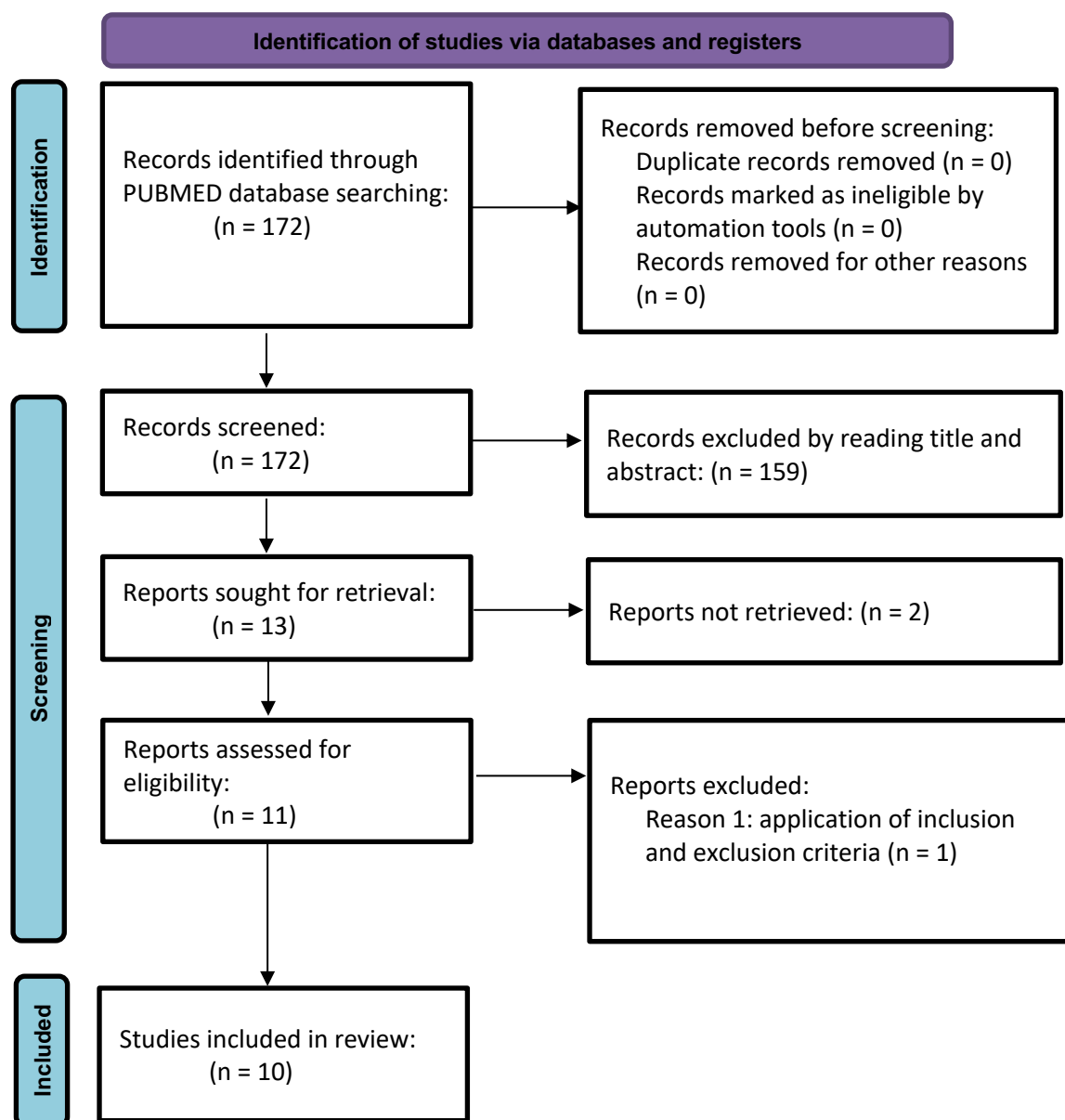


Figure 2. PRISMA 2020 flow diagram.

The following table shows the results of this assessment (**Table 1**) in which 10 articles related to the effect of OAOT protocol to the marginal bone loss (MBL) were evaluated. All the ten articles are randomized clinical trials.

	Author and year	N° of patient and N° of implant placed	Test group (TG)	Control group (CG)	Results
1	Molina et al., 2017 (42)	40 patients and 60 implant placed. 31 implants for CG, 29 implants for TG. Type: Vario SR abutment (Camlog Biotechnologies AG).	Definitive abutment (Group B).	Healing abutment (Group A). Two disconnections of the abutment.	In the follow up of 12 months the amount of interproximal bone level (DIB) change with a minimal difference between the test group (0.59mm) and the control group (1.21mm). However, the ideal stability of peri-implant soft tissues in both groups was due to the use of platform-switched abutments. Radiographic assessment: standardized periapical digital radiographs.
2	Sanz-Sánchez et al., 2024 (43)	39 patients and 60 implant allocated. 31 implants for CG, 29 implant for TG. Type: Vario SR abutment (Camlog Biotechnologies AG).	Definitive abutment.	Conventional healing abutment. Two disconnections of the abutment.	In the follow up of 5 years the values of interproximal bone level (DIB) are higher in control group, with a mean of 0.97mm, while test group mean of 0.53mm; but they are not statistically relevant. However, OAOT protocol shows greater advantages in the reduction of peri-implantitis cases

					respect to the conventional protocol. Radiographic assessment: standardized periapical digital radiographs.
3	Freitas Guimarães Praça et al., 2020 (44)	24 patients and 24 implants. 12 implants for CG, 12 implants for TG. Type: Zimmer Biomet.	Definitive abutment group (DEF).	Healing abutment group (HEA). Three disconnections of the abutment.	After 2 years of follow up, bone level between DEF and HEA group shows no significant differences (DEF mean -0.61mm and HEA -0.81mm). The peak of the MBL is showed between the implant placement and the following 6 months, same for both groups. Between the 6 month and 1 year the MBL remain stable in both groups. Radiographic assessment: standard radiographs.
4	Ríos-Santos et al., 2020 (45)	160 patients and 258 implants. 141 implants for CG, 117 implant for TG. Type: Klockner Implant System.	Definitive abutment group (DEF).	Healing abutment group (HEA). Four disconnections of the abutment.	In this study, after 1 years of following up, the peri-implant bone loss is higher in HEA (mean of - 0.216) and lower in DEF (mean of - 0.431), but without any statistical significance. Additionally, two subgroups are created based on

					the height of the abutment: 1mm high in subgroup A and 2mm high in subgroup B, the results show a reduction in bone loss using the higher abutment. Radiographic assessment: standardized clinical radiographs.
5	Pohl et al., 2025 (46)	26 patients and 26 implants. 13 implants for CG, 13 implant for TG. Type: Nobel Biocare.	Definitive abutment placement after 4 days to the implant surgery.	Healing abutment at the day of the implant surgery. Definitive abutment and definitive prosthesis placed 3 months after implant surgery. Two disconnections of the abutment.	After 1 year, the bone loss between the two groups do not show a significant difference (mean of -0.55mm mesial and -0.86mm distal for DEF; mean of -0.15mm mesial and -0.30 distal for HEA). In this case the preservation of peri-implant bone is the key for the ideal outcome in aesthetic area implant placement. The OAOT shows a benefit in the soft tissue support and adaptation, very important in a maxillary aesthetic area. Radiographic assessment: periapical radiographs.

6	Calatrava et al., 2024 (47)	40 patients and 80 implants. 40 implants for CG, 40 implants for TG. Type: Camlog Biotechnologies.	Definitive abutment group.	Healing abutment group. Three disconnections of the abutment.	After 12 months of follow up, MBL was: mean of DEF -0.53 and mean HEA -0.01. There is a positive influence in reduction of bone remodeling using OAOT protocol, in which the definite abutment is collocate the day of the implant surgery. Radiographic assessment: periapical digital radiographs.
7	Bressan et al., 2017 (48)	80 patients and 128 implants. 70 implants for CG, 58 implants for TG. Type: Ankylos (Dentsply Sirona implants).	Definitive abutment immediately after implant placement + immediately non-occlusal loaded implant with provisional.	Healing abutment after implant placement + conventionally loaded implants after 3 months. Four Disconnections of the abutment.	At 3 years of follow up the repeated disconnection of the healing abutment show more MBL respect the definitive abutment placed at the time of implant surgery, but this difference between the two group is not clinically valid (mean HEA 0.61 and mean DEA 0.11). Radiographic assessment: periapical radiographs.

8	Linkevicius et al., 2021 (49)	64 patients and 64 implants placement. 32 implants for CG, 32 implants for TG. Type: MIS implant technologies.	Immediate tissue level (ITL) abutment group.	Healing abutment group. Four disconnections of the abutment.	A significant difference in bone loss is showed between the two groups, 1 month after the placement of final prosthesis. While after 1 years of follow up wasn't significant difference in MBL between the immediate abutment group (mean -0.06) and the healing abutment group (mean -0.21). Radiographic assessment: periapical standardized radiographs.
9	Borges et al., 2018 (50)	33 patient and 68 implants. 22 implants for group A, 16 implants for group B, 30 implants for group C. Type: AstraTech EV implant.	Definitive abutment in group A (with 2mm height abutment) and in group B (with 1 mm height abutment).	Healing abutment in group C. Four disconnections of the abutment.	After 1 year of follow up the MBL means of groups was: -0.44 for group A, -0.33 for group B, -0.38 for group C. From these results no significance difference was found, neither between definitive abutment groups (group A and B) and the healing abutment group (group C), neither between the height of abutment used (2mm or 1mm). But the curve of cumulative percentage of peri-implant bone loss shows more

					linearity in bone loss of group A, while group B and group C shows same curve of MBL. Radiographic assessment: periapical radiographs.
10	Moreira et al., 2021 (51)	31 patient and 53 implants. 30 implants for CG, 23 implants for TG. Type: Klockner VEGA implant system.	Definitive abutment group (DEA).	Healing abutment group (HEA). Three disconnections of the abutment.	When comparing the DEA group and the HEA group at the end of 12 months any differences in marginal bone loss are found. Both protocols, conventional protocol and OAOT protocol have the same effect on changing marginal bone (mean HEA 0.21 and mean DEA 0.14). Radiographic assessment: standardized periapical digital radiographs.

Table 1. Results summary of Definitive abutment, following the concept of OAOT vs Conventional protocol, in which the healing abutment is repeatedly connected-disconnected.

4.1. Group comparison:

In the 10 selected prospective studies, two groups were compared: the test group, which included patients that received the definitive abutment at the moment of implant surgery, following the OAOT protocol, and the control group formed by patients that received the healing abutment at the moment of implant surgery, following the conventional protocol. In the test group, the definitive abutment is not removed, thus remaining the same throughout the whole prosthetic phase, and is the abutment where the definitive prosthetic restoration will be in the

end placed. On the other hand, in the control group, the healing abutment is repeatedly disconnected and reconnected (between two and four times) during the next three/four months corresponding to the osseointegration phase, or healing period. After this period, the healing abutment is removed and is replaced with definitive abutment in which restoration is screwed/cemented on it. Moreover, by following the conventional protocol, the healing abutment in the control group was removed and repositioned three times, to allow the prosthetic phase: the first time is removed during the impression, the second time is removed to test the prosthetic abutment, and the third time is removed to allow the placement of permanent abutment and the prosthetic restoration. In all studies included in this systematic review, the test group corresponds to definitive abutment placement, following OAOT protocol, whereas the control group corresponds to healing abutment placement, following conventional protocol with repeated abutment disconnection.

4.2. Radiographic assessment methods:

All randomized clinical trials included in this review assessed the MBL through the most common method, which is standardized intraoral radiographs. Following the assessment of the radiographs, they are calibrated to correct real dimension of image, magnification, greyscale and to correct the image distortion, ensuring accuracy and high-quality image. In none of the studies included, the MBL was assessed by CBCT scan. CBCT was only used in the pre-operative process to study the placement of implants.

4.3. Marginal bone loss outcomes:

The primary outcome of this systemic review was evaluating the MBL surrounding the dental implants, after applying the OAOT protocol or the conventional protocol for restoration. All the randomized clinical trial studies included in the review evaluated the level of peri-implant bone changes radiographically after a minimum follow up of 12 months. The first assessment was detected the day of implant surgery, and the last one considered was detected at the end of the follow up period.

The marginal bone changes were measured as a linear distance from defined implant reference point, as implant shoulder or implant-abutment interface, to the first bone-to-implant contact. The reference points changed depending on the study. Measurement of mesial and distal bone level were detected in the studies, then either the values are analyzed separately, or a mean

was calculated. Due to differences in reporting methods, some authors expressed bone changes as positive values while others reported negative values depending on the implemented calculation formula that has been adopted.

4.4. Implants and abutment characteristics:

A total of seven type of implant/ abutment were mentioned in the included articles: Camlog Vario SR (Biotechnologies AG), Zimmer Biotech, VEGA Klockner Implant System, Nobel Biocare, Ankylos (Dentsply Sirona implants), MIS implant technologies, Astratech EV implant system.

In some studies, additionally, was specify the usage of platform switching in which the diameter of the abutment is narrower than the diameter of the implant platform, by shifting the interface implant-abutment inward.

In the following table (**table 2**) the quantitative results are resumed, including the mean MBL of OAOT protocol, the mean MBL of conventional protocol, standard deviation (SD), the *p*- values.

Study	Mean MBL + SD	Mean MBL + SD	P – values	Follow up
	OAOT	CONVENTIONAL		
Molina et al., 2017 (42)	0.590 ± 0.322	1.210 ± 0.816	0.121	12 months
Sanz-Sánchez et al., 2024 (43)	0.534	0.972	0.063	5 years
Freitas Guimarães Praça et al., 2020 (44)	-0.181	-0.133	0.792	2 years
Ríos-Santos et al., 2020 (45)	-0.431 ± 0.796	-0.216 ± 0.710	0.103	12 months

Pohl et al., 2025 (46)	-0.55 ± -0.86	-0.15 ± -0.30	>0.05	12 months
Calatrava et al., 2024 (47)	-0.53 ± 0.54	-0.01 ± 0.55	0.008	12 months
Bressan et al., 2017 (48)	0.11 ± 0.2	0.61 ± 1.0	0.004	3 years
Linkevicius et al., 2021 (49)	-0.06 ± 0.16	-0.21 ± 0.56	0.223	12 months
Borges et al., 2018 (50)	Group A: -0.44 ± 0.59 Group B: -0.33 ± 0.31	Group C: -0.38 ± 0.40	0.752	12 months
Moreira et al., 2021 (51)	0.14 ± 0.21	0.21 ± 0.27	0.330	12 months

Table 2. Mean measurement of marginal bone loss (MBL) + Standard deviation (SD), following on abutment-one time (OAOT) protocol and conventional protocol, in follow up period.

Table 2 reports that in some studies there is a significant difference in MBL, when the OAOT protocol is compared with the conventional protocol. A difference considered statistically significant is represented by p-value < 0.05, but its clinical relevance should be carefully interpreted. Whereas several studies establish no significance differences in MBL between OAT protocol and conventional protocol.

Table 2 reports the final level of marginal bone detected. But during all treatment period starting with the implant placement and ending 1 year/2 years after the loading implant, the marginal bone goes through a series of changes.

4.5. RoB:

Following for the critical assessment, to evaluate the validity of the randomized clinical trials included in this systematic review, the Cochrane risk of bias (RoB) was created (52) (**Table 3**).

The bias assessed were:

- D1: Bias arising from the randomization process
- D2: Bias due to deviations from intended interventions (patients lost during follow up)
- D3: Bias due to missing outcome data
- D4: Bias in measurement of the outcome (measurement done by blinded and calibrated examiner (AM))
- D5: Bias in selection of the reported results

Study	D1	D2	D3	D4	D5	Overall
Study 1: Molina et al.	Low 	High 	Low 	Low 	Low 	Low risk 
Study 2: Sanz-Sánchez et al.	Low 	High 	High 	Low 	Low 	Some concerns 
Study 3: Praça et al.	Low 	High 	High 	Low 	Low 	Some concerns 
Study 4: Ríos-Santos et al.	Low 	High 	Low 	Low 	Low 	Low risk 
Study 5: Pohl et al.	Low 	High 	Low 	High 	Low 	Some concerns 
Study 6: Calatrava et al.	Low 	High 	Low 	Low 	Low 	Low risk 
Study 7: Bressan et al.	Low 	High 	Low 	Low 	Low 	Some concerns 
Study 8: Linkevicius et al.	Low 	High 	Low 	Some concerns 	Low 	Some concerns 
Study 9: Borges et al.	Low 	High 	Low 	Low 	Low 	Low risk 
Study 10: Moreira et al.	Low 	Low 	Low 	Low 	Low 	Low risk 

Table 3. Summary of the RoB2 that presents the review author's assessments of each bias domain for every study included.

In the 10 studies included in this review, the participants were randomly assigned to one of the two groups treatment: definitive abutment group following the one abutment-one time protocol or healing abutment group following the conventional protocol. In nine studies the deviation from intended interventions shows high RoB due to patients missing in the following up period, only one study concluding with the same measurements as the initial ones. In two

studies the standard deviation values (SD) data was missing. The measurement of the outcome in all the studies except two, were done by blinded and calibrated examiner (AM), an independent investigator who assesses study outcomes without knowing which treatment the patient received. All the ten studies reported comprehensible results, publishing the finding base on the result of the study, without favoring the positive results or omitting the outcome results that which weren't statistically significant. The overall data reported in the table was based on the five different domains.

5. DISCUSSION

This systemic review shows a statistically significant difference in marginal bone loss (MBL) comparing the one abutment-one time (OAOT) protocol to conventional protocol, two studies of ten included. A study performed by Calatrava et al. of 2024 (47) and a study performed by Bressan et al. of 2017 (53) found a difference comparing the two protocol, showing decreased marginal bone loss in the definitive abutment group study following the OAOT protocol, respectively: p-value 0.008 at 12 months follow up for Calatrava study and p-value 0.004 at 3 years follow up for Bressan study. In the other eight study included in the review no statistically significant difference was observed, resulting in equal MBL values, when comparing the two protocols in a varied follow up from 12 months to 5 years.

5.1. One abutment-one time protocol vs conventional protocol:

A study performed by Molina et al. 2017, follow up of 12 months shows no statistical significance between the OAOT protocol and conventional protocol in MBL, measured by distance implant shoulder – first bone-to-implant contact (DIB (mm)), the mean of MBL in DEA group was 0.590 while in HEA group was 1.210, p-value of 0.121. However, it was established a significant difference in MBL during the healing period, between surgery – 6 months, in this period the major resorption of bone occurs, showing more MBL in healing abutment group following conventional protocol (mean MBL in definitive abutment group was -0.605 ± 0.396 ; mean MBL in healing abutment group was -1.235 ± 0.790 ; p-value 0.028). After the first 6 months, from the surgery, the bone remains stable with minimal changes. The conventional protocol characterized by multiple disconnection-reconnection of the abutment affects the marginal bone during the healing period, increasing the resorption compared to the OAOT protocol. To minimize the bone loss and to improve peri-implant mucosa in this study was used platform

switching abutment in both groups. Due to platform switching, peri-implant soft tissue stability results ideal in both treatment groups (42).

Calatrava et al. 2024, demonstrated a reduction of MBL in group using OAOT protocol. At 12 months of follow up the mean MBL was -0.53 ± 0.54 for DEA group and -0.01 ± 0.55 for HEA group (3 disconnection and connection of abutment during the prosthetic phase), with p-value of 0.008. Then a significance difference was observed in MBL changes between surgery – 6 months (mean of DEA group: 0.48 ± 0.37 ; mean of HEA group: 1.03 ± 0.48 ; p-value was ≤ 0.01) and was observed in MBL change between surgery to 12 months (mean of DEA group was 0.57 ± 0.55 ; mean of HEA group was 1.14 ± 0.51 ; p-value was ≤ 0.01). The papillae fill resulted the same in both group after 12 months from the loading (47).

In the study conducted by Bressan et al. 2017, a high statistically significance difference was established (with p-value 0.004) between OAOT protocol and conventional protocol in peri-implant marginal bone loss at 3 years follow up after loading, in which repeated abutment disconnection had a negative effect. Numerically, 70 implants were analyzed in the healing abutment group and 58 implants in the definitive abutment. The mean of bone level for DEA group was 0.11 ± 0.2 while the mean for HEA was 0.61 ± 1.0 . Additionally, a statistically difference (p-value 0.007) was observed in the period surgery- 3 years, the mean for DEA group was 0.07 ± 0.18 while the mean of bone level for HEA group 0.50 ± 0.93 , the four disconnections of the abutment cause more peri-implant bone loss. But this study has some concerns about some missing data and the study concluded that this differences in peri-implant tissue were not clinically relevant (53). In both studies, Calatrava and Bressan, the peri-implant bone is affected positively thanks to the subcrestal placement of the implants, thus reducing any possible future resorption.

The study carried by Borges et al. in 2018 found a similar outcome comparing the two protocol of abutment connection timing, this study additionally compared two different abutment height in the definitive abutment group. The mean of peri-implant bone at the end of the study, 12 months after surgery, for group A (immediate placement of definitive abutment with 2 mm height abutment) was -0.44 ± 0.59 ; for group B (immediate placement of definitive abutment with 1 mm height abutment) was -0.33 ± 0.31 ; for group C (healing abutment with 2 mm height abutment placed in a second stage) was -0.38 ± 0.40 ; p-value of 0.752. These results show no statistically significance difference between OAOT protocol and conventional protocol, with slightly more MBL in the healing abutment group that was disconnected and reconnected four

times, causing the disruption of mucosal barrier. At the end of this investigation, it was evidenced that the MBL differed in the varied measurement time (time of surgery; 1 month after surgery; 4 months after surgery; 12 months after surgery). Group A and group B which presented same abutment timing protocol but different abutment height, resulted in equivalent variation of bone loss over the different follow ups, whereas the group C result unfavorable one, with more bone loss after 1 month from the surgery and at the 12 months follow up. The amount of bone loss observed one month after surgery can help predict marginal bone loss over the following 12 months. Can state that, following the result given from this study, that abutment timing protocol dominated the MBL, leaving the height of abutment in second place which resulted in an irrelevant difference regarding varied measured time (50).

The radiographic measurement in the study carried by Moreira et al., in 2021 doesn't highlight any difference in MBL between the two groups studied; after 12 months the result was 0.14 ± 0.21 for definitive abutment group and 0.21 ± 0.27 for healing abutment group. Moreover, platform switching concept was applied, but presented not statistically significance difference in the usage of OAOT protocol or convention protocol. This study is the only one that followed all the five demand of risk bias and finalized the best result of low risk (51).

A study included in this systematic review with the longer monitoring was conducted by Sanz-Sánchez et al. 2024. The assessment of MBL after 5 years was DEA mean 0.534; HEA mean 0.972; p-value 0.063, no statistical significance in MBL between the two groups, but slightly higher in healing abutment group. However, a statistically significance difference was found with p-value (intragroup) of 0.021, for healing abutment group, during the 5 years (mean at surgery: -0.069; mean at 5 years 0.972). This study also shows that the greatest bone changes was occurred between 12 months and 36 months, with a radiographic bone formation of 0.11mm for DEA group and 0.39mm for HEA (43).

5.2. Bone changes variables:

The marginal bone surrounding a dental implant goes through numerous changes. In this study an interaction between multiple abutment characteristics and marginal bone loss was analyzed, leading to document that MBL not exclusively depends on the protocol implemented (OAOT protocol /conventional protocol).

A study conducted by Ríos-Santos et al. in 2020, examining a total of 141 implants for healing abutment group and 117 implant for definitive abutment group, combined platform switching in both groups, while the two different heights of abutment (1mm or 2 mm) were decided by the clinician: for DEA group was decided the day of surgery while for HEA group was decided when the impression was taken based on the thickness of the mucosa, so two subgroups were created respectively on height of abutment chosen. This study highlighted the influence of abutment height, showing after 1 year the values of MBL, which were -0.20 ± 0.78 mm placed 1mm abutment compared to 0.43 ± 0.70 mm placed 2mm abutment. The result statistically significance (with p-value 0.02) reports a minor bone loss in the taller abutment (2mm abutment group); while no statistically significant difference was found, after 1 year, in peri-implant bone loss (the mean of MBL in definitive abutment group was -0.431 ± 0.796 ; the mean of MBL in healing abutment group was -0.216 ± 0.710 ; p-value of 0.103). This study concludes that the group in which was combined platform switching with taller abutment, presents less MBL (45).

5.3. Soft tissue augmentation:

The soft tissue augmentation is a crucial factor for aesthetic domain in implant restoration, to take into consideration when choose the protocol. However, in most of studies included in this review any difference was observed. The two protocols performed, OAOT and conventional, attained the same result in the stability of peri-implant soft tissue and papilla fill. In a study of 2017 conducted by Bressan et al., a total of 22 implants were placed to restore teeth in aesthetic area, which includes upper jaw from canine to canine, divided into 5 implants (4 abutment disconnection group/ 1 definitive abutment group) in canine position and 17 implants (7 abutment disconnection group/ 10 definitive abutment group). A relevant result that was detected in soft tissue contour implants, assessed by pink aesthetic score (PES) at 3 years after loading the value, was more favorable in definitive abutment group (1.56 ± 0.50 for healing abutment; 1.82 ± 0.39 for definitive abutment; difference of 0.26) so a statistically significance difference was found (p-value 0.015) (53).

A better peri-implant soft tissue adaptation occurs in OAOT protocol due to positioning the definitive abutment without any remotion, while a slightly lower adaptation was displayed in the conventional protocol leading to a disconnection of healing abutment from 2 to 4 times during the prosthetic phase. While this disconnection occurs, a disruption of the mucosa can transpire, compromising the adjustment of soft tissue around the implant abutment and

consequently compromising the aesthetic outcome. This is a fundamental aspect to consider while designing dental implants in aesthetic areas.

5.4. Limitations:

This review presents some limitations that may influence how the results are interpreted. One limitation is the lack of long-term studies evaluating this protocol, most of the study included were monitoring 12 months from the surgery implant placement. Extended monitoring over time is required to better understand whether the potential benefits of the OAOT protocol are maintained over time. In addition, the included studies analyzed different implant system and abutment design. This variability, including differences in factors such as platform switching and abutment height, makes direct comparison between studies more difficult and may influence the outcomes.

6. CONCLUSIONS

The null hypothesis of this systemic review is accepted, there are no substantial differences in marginal bone loss using the one abutment-one time (OAOT) protocol or the conventional protocol in dental implant procedures, after a monitoring period of at least 12 months. The first 6 months after the implant placement, corresponding to the healing period, is the crucial moment in which the difference in marginal bone loss was found concluding slightly less bone loss in definitive abutment group. Moreover, OAOT protocol shows advantages in the support of surrounding soft tissues, protection to microbiological fluid attack, maintaining the stability and creating ideal adaptation of peri-implant mucosa. To decide really between OAOT protocol and conventional protocol application, always a specific analysis of the patient case is needed during the planning of implant surgery.

7. SUSTAINABILITY

The concept of sustainability can also be applied to modern implantology protocols such as the one abutment-one time (OAOT) implant protocol. By limiting the number of abutment disconnections, this method reduces the use of clinical materials, sterilization procedures and laboratory components, contributing to lower environmental impact and more efficient resource use. From an economic perspective, the simplification of clinical steps leads to shorter

treatment times, lesser appointments and lesser costs. Results in reduction in timing for both the professional and the patient. Moreover, conserving the integrity of the peri-implant tissues minimizes biological complications, improving the long-term success rate of the implant and decreasing the need for corrective procedures. This directly supports social sustainability, as patients experience greater comfort, faster healing, and a more predictable outcome, enhancing their quality of life. Therefore, the OAOT protocol aligns with the principles of sustainable dentistry by combining clinical reliability with responsible management of time, costs and environmental resources.

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