



## Dental implant and aesthetics: a systematic review

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### Abstract

**Introduction:** Besides the aspects of oral physiological functions, visual appearance and aesthetics have been addressed as an important factors in this type of therapy. In restorative dentistry, a pleasant aesthetic has been described as a blending of natural dentition and prosthetic elements, in addition to the identification, adaptation, and correct conditioning of these elements with the marginal and peripheral tissues. **Objective:** The present study aimed to present the main factors supporting aesthetic excellence before and after the rehabilitation of former regions' use of dental implants. **Methods:** The systematic review rules of the PRISMA Platform were followed. The search was carried out from February to May 2023 in the Scopus, PubMed, Science Direct, Scielo, and Google Scholar databases, using articles from 1985 to 2022. The quality of the studies was based on the GRADE instrument and the risk of bias was analyzed according to the Cochrane instrument. **Results and Conclusion:** A total of 98 articles were found, 38 articles were evaluated in full and 31 were included and developed in this systematic review study. Considering the Cochrane tool for risk of bias, the overall assessment resulted in 10 studies with a high risk of bias and 30 studies that did not meet GRADE. It is important to know the biological structures of the soft and hard tissues around an osseointegrated dental implant (peri-implant referred to as peri-implant phenotype), in the context of peri-implant esthetic complications. Aesthetics has become a primary factor in the patient's expectations, and the duty of the surgeon's professional knowledge of the fundamental aspects in achieving this aspect of a correct treatment plan to meet the

appropriate restorative and surgical protocols, thus being able to achieve satisfactory results is required. It notes that all efforts should be aimed at the final result.

**Keywords:** Dental implant. Aesthetics.

### Introduction

Besides the aspects of oral physiological functions, visual appearance and aesthetics have been addressed as an important factors in this type of therapy [1]. In restorative dentistry, a pleasant aesthetic has been described as a blending of natural dentition and prosthetic elements, in addition to the identification, adaptation, and correct conditioning of these elements with the marginal and peripheral tissues [2]. The use of implants in the anterior regions has been widely distributed due to the development of different techniques, both for handling the periodontal tissues and for the measurement and modeling of bone tissue as well as in the development of new materials related to prosthetic resources [3].

Thus, the clinical evaluation and treatment planning should be carried out to take into account the individual needs and expectations of each patient, making the specific treatment and ensuring satisfaction with the existing aesthetic complaints. The use of implants as replacements for lost or missing teeth has been reported in the literature as a good therapy success and survival rate [4]. Its positive results are related to the predictability, efficiency, and reliability of this type of treatment in the replacement of lost teeth and the re-establishment of mastication, swallowing,

speech, smiling, and even in acting positively in patients with painful orofacial symptoms [1,2]. Peri-implant aesthetics in contemporary dentistry have lived a constant pursuit of excellence to meet patients who become increasingly differentiated and often lay high expectations regarding the outcome of their treatment [1].

In this context, it is important to know the biological structures of the soft and hard tissues around an osseointegrated dental implant (peri-implant referred to as peri-implant phenotype), in the context of peri-implant esthetic complications. The individual components of the peri-implant phenotype (keratinized mucosa width, mucosa thickness, and peri-implant buccal bone) have been associated with different aspects of implant esthetics as well as health-related aspects [5].

Thus, the present study aimed to present the main factors supporting aesthetic excellence before and after the rehabilitation of former regions' use of dental implants.

## Methods

### Study Design

The systematic review rules of the PRISMA Platform were followed. Available at: [www.prisma-statement.org/](http://www.prisma-statement.org/). Accessed: 03/18/2023. A search protocol was developed to identify the evidence related to determinants for good aesthetics in implantology. Thus, the study included should report different aspects and may involve different tissues (gum and bone), surgical techniques, materials, and expectations of the patient and report them with getting a nice aesthetic when rehabilitation involved anterior regions.

### Research Strategy, Quality of Studies and Risk of Bias

The search strategies for this systematic review were based on the keywords (MeSH Terms): The research was carried out from February to May 2023 in Scopus, PubMed, Science Direct, Scielo, and Google Scholar databases. In addition, a combination of keywords with the Booleans "OR", "AND" and the operator "NOT" were used to target scientific articles of interest. The quality of the studies was based on the GRADE instrument and the risk of bias was analyzed according to the Cochrane instrument.

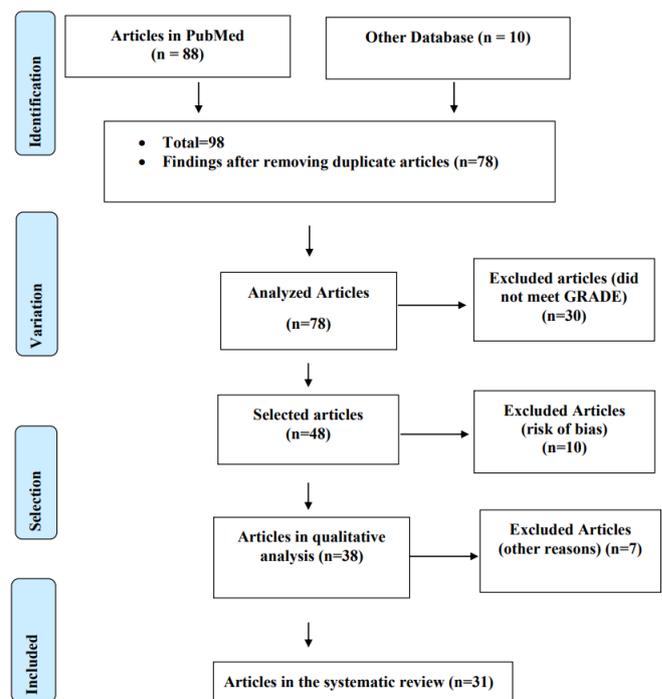
## Results and Discussion

### Summary of Findings

A total of 98 articles were found. Initially, duplication of articles was excluded. After this process, the abstracts were evaluated and a new exclusion was

performed, removing the articles that did not include the theme of this article, resulting in 48 articles. A total of 38 articles were evaluated in full and 31 were included and developed in this systematic review study (Figure 1). Considering the Cochrane tool for risk of bias, the overall assessment resulted in 10 studies with a high risk of bias and 30 studies that did not meet GRADE.

Figure 1. Flowchart - Article Selection Process.



Source: Own authorship

The profile design of stable peri-implant tissues and aesthetically pleasing results with dental implant restorations, influenced by factors such as implant position and the surrounding soft tissues is of paramount importance not only for esthetic purposes but also for implant success dental. Biological aesthetic contour considers specific parameters for the adequate design of the emergence profile of implant-supported restorations. Understanding the different zones of the emergence profile and their relationship to factors such as implant position, implant design, and soft tissue thickness is critical [6].

With the emergence of dental implants created a great expectation in dentistry since structural loss could be re-established, generating solutions to the cases of free ends, and anterior and posterior unitary losses without the need for involvement of adjacent teeth for replacement [7]. The authors of the most important studies on implantology describe the presurgical phase as vitally important to a predetermined and predictable result. Advocated the use of a tool called "reverse planning" which is described by the author as

indispensable within the implant. The technique is based on establishing a surgical protocol and rehabilitation which considers the identification of the prosthetic defect that the patient has and results in the construction of a clinical simulation result, allowing predictability in implant treatment, with a fundamental application mainly aesthetic areas [8, 9].

Another technique is discussed in the literature related to the immediate deployment after surgical procedures. The authors described the experience with the use of immediate implants in the anterior maxilla. The main objective of the study was to evaluate the predictability of the architectural maintenance of soft and hard tissues and perform cosmetic restoration [10]. The success of osseointegration was analyzed in the improved patient comfort and acceptance of the same treatment. The results showed that the implant maintained its stability after the primary "conventional" period of six months and osseointegrated was considered. The soft tissues also remained favorable and most patients maintained gingival architecture (including the interdental papillae), harmony and continuity of hard and soft tissues were predicted in all cases. The application of this technique seems promising, but there is a need for more controlled clinical studies that have longer periods of monitoring to demonstrate their total predictability when this technique is related to the stability of the peri-implant tissues [11,12 ].

Also, a correct deployment to be aesthetically acceptable depends on an ideal three-dimensional position, fixing, and stable and aesthetic soft tissue contours [1,2]. The authors presented a case of rehabilitation of bilateral lateral incisors with a range of surgical techniques, to preserve the existing gingival structure and concluded that the incision groove bottom allows the maintenance of gingival aesthetics achieved with conventional prostheses. Thus, it is concluded that maintaining the quality of the soft tissue in cases that require bone reconstruction is a major challenge for implant dentists. This difficulty had already been reported, which suggested that the refinement and obtaining optimal soft tissue profile are intermediate clinical procedures that can be performed after placing the abutment [13-17].

Due to the simplicity of the technique, the predictability and the proven strength of the metal pillars make these the most suitable in most cases prosthetic [5]. Nevertheless, the use of intermediate metal can result in changes at the endpoint of pure porcelain crowns due to its darkened color, and the possibility of dimming the gingival margin when it is very thin. Thus, for the above regions, the use of

aesthetics called pillars, particularly ceramic may be indicated because of lower load and higher masticatory esthetic demands. Other authors reported that the components made from zirconium oxide are a very interesting option since they combine biocompatibility, aesthetically pleasing, and high fracture resistance [18,19].

In working with Cutrim et. al. (2011) [13] ceramic abutments are indicated in the unit replacement of any tooth where aesthetics are paramount and may be considered an alternative in other clinical situations, including in the upper region. Mosque et al. (2006) [20], reported a case of an implant-supported restoration made on a ceramic abutment of Zirconia and observed the zirconia abutment offers favorable substrate fabrication of ceramic crowns, allowing to achieve better cosmetic results than metal components in the previous region is indicated more specifically to areas with sufficient thickness to gum a metallic component.

For a long time, the physiological functions were the main factors for implant treatment, but with the evolution and development of new techniques, these began to be also for previous regions, such as in cases involving lack of single tooth or multiple [2,3]. The aesthetic need for the implant to be "equal" to the lost tooth, which is natural, is the greatest desire of those seeking implant treatment. Thus, the restoration of the missing natural dentition has an additional impact on the individual and social personality of the patient. Experience has proven that most patients not only realize the functional improvement provided by prosthetic treatment but also a significant spiritual and social improvement as a result of the change in appearance [20,21].

For Figueiredo et al (2011) [14], the prosthetic rehabilitation of edentulous space isolated in the anterior maxillary region is critical due to the high demand for aesthetics involved in the resolution of these cases. Even after conventional prosthetic rehabilitation, it is common to observe, patients, with some degree of dissatisfaction with the final aesthetic result, since various aspects like the shape and the amount of remaining bone, the quantity and quality of the mucosa, and also the aesthetic characteristic of the prosthetic components used must be favorable so that we can achieve an aesthetically harmonious result.

According to the literature review in this work the pursuit of aesthetics when using implants seems to depend on some factors that are considered important, and according to the percentage of bibliographic findings: 1) Diagnosis and Planning; 2) Reverse Planning; 3) Handling of Soft and Hard Tissue; 4) Peri-implant

fabric; 5) Prosthetic Resources; and 6) Psychological factors associated with Aesthetics. Thus, these factors will be discussed for a correct indication and use of implant therapy in aesthetic anterior regions [1].

### Diagnosis and Planning

The diagnostic process should be performed by obtaining the clinical data of the patient, the use of diagnostic imaging tools, and anamnesis application, and the determination of the patient's expectations regarding the treatment in question. These factors are essential and their absence or failure can result in incorrect planning with consequent dissatisfaction of the patient [1].

For the initial planning, the surgeon should evaluate some anatomical aspects of the area to be rehabilitated. According to Buser et. al. (2000) [12], this evaluation includes a variety of aspects such as the shape and thickness of the bone crest, presence or absence of vestibular depression, conditions of the neighboring teeth, intermaxillary relationship, presence or absence of diastema, thickness, and contour of the buccal mucosal tissues, the papilla position, quality of gum phenotypes and the smile line location. Furthermore, periodontal and endodontic conditions, root inclinations, and the situation of the crowns of remaining teeth should be carefully studied, and not in good condition should be treated previously.

The replacement of affected teeth may be accomplished by immediate implants in cosmetic fields. This type of intervention may give the patient a more comfortable treatment with less invasive surgery and a shorter interval of time [22,23]. However, some authors as Tosta et. al. (2007) [24] argue that the remodeling of peri-implant tissues after extraction, even after immediate implant placement may compromise the aesthetic outcome of treatment.

In general, careful clinical, radiographic, and tomographic reviews, study analysis models mounted on semi-adjustable articulators and the application of diagnostic waxing are for a correct diagnosis and optimal planning according to each case.

### Reverse Planning

An implant-supported restoration is to be considered appropriate to promote harmony between the functional, aesthetic, and biological aspects. These concepts have resulted in the development of a protocol entitled "Reverse Engineering", where implants are positioned according to the requirements dictated by the restoring phase and not the bone condition available in the area [1,2].

Initially, is established a protocol based on the

identification of the prosthetic defect that the patient has and the subsequent construction of a simulation of clinical outcome. According to Francischone et. al. (1998) [15], this technique allows evaluation of the determinants to obtain aesthetics in implantology, especially those related to the reconstruction of bone architecture, resulting in better three-dimensional positioning of the implant, combining proper handling of soft tissue during deployment (1st surgical phase) as well as the reopening of the implants (surgical 2nd phase).

### Manipulation of Soft And Hard Tissues

Several clinical procedures involving surgical mucogingival therapy and nonsurgical have been developed by several authors to improve aesthetics in treatments made using implants [14]. The success of these rehabilitations requires not only the osseointegration of the implant but mainly the ideal three-dimensional positioning of the implant and the outline of stable and aesthetic soft tissue. Often the lack of such tissues or improper handling during the processing results in a greater number of procedures, extending the time and cost of treatment [3,14].

The manipulation of the soft tissues at the time of tooth extraction can be decisive for the final aesthetic result. The refinement and obtaining the tissue profile, on the other hand, are intermediate clinical procedures that can be performed after the placement of the column. If some surgical corrections mucogingival need to be employed, these can be performed before or after the placement of the implant, reconstructing the lost contours [25-28].

When the ready placement of implants and a temporary prosthesis is performed, care must be taken not to affect the gingival contour may be modified, for example, for some molding procedures, test prostheses, and components. If they occur, these defects can be corrected with the use of connective gingival grafts promoting gum thicker and favorable margin entrance exam [29-31].

### Peri-implant Tissue

In cases where the control of bacterial plaque is performed satisfactorily, the peri-implant tissue may exhibit characteristics such as color, texture, consistency, and similar bleeding much with normal periodontal corresponding [1-3]. The gingiva around natural teeth and the mucosa overlying the implants differ in the composition of connective tissue, the alignment of collagen fibers, and the distribution of vascular structures in the apical portion of the junctional epithelium [13].

The probing depth around implants can reach the alveolar bone due to inconsistent coupling between the peri-implant mucosa, and the surface of the implant. Because of this depth, Lindhe et. al. (1992) [18] showed that, compared to biofilm accumulation, inflammatory response often involved implants in bone tissue, while for natural teeth inflammation is restricted to the gingival tissue. The following section the same line of reasoning, reported that maintaining the health of the peri-implant mucosa is a critical factor since the sealing of the gingival tissues around the implants is not effective progression of periodontopathogenic microorganisms when poor oral hygiene and a negative control board are present.

In natural teeth collagen fibers that adhere to the cementum are essential to the health of the periodontal tissue in question, whereas in accession implants these are not essential to the success of perimplanting health. Some authors describe the existence of a circular formation of collagen fibers that support the junctional epithelium between the implant and the bone, even so, the grip between them seems to be an area of weakness. The peri-implant mucosa is made up of keratinized epithelium, the sulcular epithelium, junctional epithelium, and a connective tissue zone formed by peri collagen fibers anchored in the marginal ridge and arranged parallel to the implant surface [13,14].

According to the same author, the insertion of the peri-implant mucosa across the different types of pillars (smooth or rough) is similar, however, several studies show that bacterial biofilm accumulation on the roughened surface of an exposed implant in the oral cavity is significantly higher in that the implant has a smooth surface. However, it is important to note that the surface roughness of the implants comes with optimal conditions for healing by providing clot stability and maintenance thereof and the surface of the implant [15].

The stability of the peri-implant bone crest in the long term is considered an essential factor for implant treatment, from the functional and aesthetic point of view [1]. Therefore, during the assessment of radiographic examinations should check the presence of vertical or horizontal bone loss and the presence of radiolucent involving the implant. This review shows the current condition of the bone that supports the osseointegrated implant [2].

### Prosthetic Resources

Many cosmetic problems related to the rehabilitation of the anterior implant, have been solved by the use of ceramic abutments. Some related factors

the implants are closely linked to the pillars or intermediaries, over time, have undergone major changes, seeking appropriate aesthetic solutions [3].

The current prosthetic concern has a wide vision, which ranges from the functional analysis to the quality and the kind of smile, the harmony of the structures involved, and the technical details of the area to be repaired [21]. Searches were carried out to define and modify the surgical protocol for treatment with dental implants by changing your design presentation and the healing time. The use of an immediate crown unit to restore teeth in aesthetic areas favors the maintenance of the hard and soft tissue region [1,2].

The implants that use a prosthetic component reduced relative to the diameter of the implant platform (far micro gap the bone crest) also appear to be able to preserve the periimplant bone level. The removal of this micro gap of the bone crest region, by reducing the diameter of the prosthetic component relative to the implant platform, reduces or eliminates bone loss, aesthetic and functional bringing significant clinical benefits [1].

Sailer et. al. (2007) [25] showed clinical cases comparing the aesthetic results achieved with pillars on titanium implants and zirconia abutments. It was concluded that for the posterior regions, prefabricated titanium pillars are listed as presenting good physical and mechanical strength and require procedures classified as simple and low cost In the anterior region, the prefabricated titanium pillars can only be recommended in cases of low aesthetic demand. In aesthetically demanding patients it is recommended to graft tissue before abutment connection. But the pillar of custom or pre-fabricated zirconia brings excellent when aesthetics is the main factor.

Regarding provisional, Padovan et. al. (2007) [22] reported that the installation of a temporary immediate super implant osseointegrated prosthesis has proven to be an excellent alternative treatment as it eliminates the use of removable denture and the need to perform the second stage surgery, providing greater comfort for the patient and optimize aesthetics, reduce costs and time of treatment, which differs from the statement of Salama et. al. (2007) [26], which further emphasizes that perform the installation immediate temporary crown only where achieve adequate primary stability. The temporary crown must be free of occlusal contacts during the period of osseointegration.

Regarding the prosthetic screwed and cemented implant, Cutrim et. al. (2011) [13] observed that there is no doubt that the primary requirement for the success of the implant is osseointegration. The prosthetic implant retention by use of cement

eliminates the making of openings, which are not aesthetic, to access the screw. However, with the use of screwed prostheses, and modern opaque composite materials their composition can reduce the grayish screw contributing to a satisfactory cosmetic result.

### Psychological Factors Associated With Aesthetics

The concept of beauty and beauty is mainly determined by cultural, geographic, social, and psychological factors. For example, a typical individual with high aesthetic requirements would be a young person, female, vain, residing in a large urban center in a Western country. In this context, examining only the expected factor of the patient, for an individual with high aesthetic requirements, reconstruction procedures deformities are shown before and/or during treatment with implants [25].

The restoration of the missing natural teeth, especially the anterior region, has an additional impact on the individual personality and social position. Experience has proven that the majority of patients not only realize the functional improvement provided by the prosthetic treatment but also a significant social and spiritual improvement, as a result of a change in appearance [28].

### Conclusion

It is important to know the biological structures of the soft and hard tissues around an osseointegrated dental implant (peri-implant referred to as peri-implant phenotype), in the context of peri-implant esthetic complications. Aesthetics has become a primary factor in the patient's expectations, and the duty of the surgeon's professional knowledge of the fundamental aspects in achieving this aspect of a correct treatment plan to meet the appropriate restorative and surgical protocols, thus being able to achieve satisfactory results is required. It notes that all efforts should be aimed at the final result.

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### Informed consent

Not applicable.

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No additional data are available.

### Conflict of interest

The authors declare no conflict of interest.

### Similarity check

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