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The importance of red aesthetics in dental implants: a systematic review

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Abstract

Introduction: Aesthetics region should be defined as any area to be restored visible in the patient's smile. The charge or immediate function is a prerequisite for the present implant's primary stability in your installation. Thus, to maintain the gingival architecture, understanding biological principles governing is essential to remodeling, as well as alveolar bone soft tissue. The gingival tissues' health, color, and texture are critical to the long-term success and the aesthetic value of treatment. **Objective:** It was to review the literature and discuss the major factors supporting the red aesthetic excellence before and after the rehabilitation of former regions, and the use of dental implants. **Methods:** The PRISMA Platform systematic review rules were followed. The search was carried out from March to June 2024 in the Scopus, PubMed, Science Direct, Scielo, and Google Scholar databases. 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:**128 articles were found, 44 articles were evaluated in full and 32 were included and developed in the present systematic review study. Considering the Cochrane tool for risk of bias, the overall assessment resulted in 20 studies with a high risk of bias and 23 studies that did not meet GRADE and AMSTAR-2. Most studies did not show homogeneity in their results, with X^2=81.5%>50%. It was concluded RED 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. A correct treatment plan to meet the restorative and surgical protocols appropriate, thus being able to achieve satisfactory results is required.

Keywords: Red Aesthetics. Gingival aesthetics. Implant dentistry. Implant rehabilitation.

Introduction

Aesthetics region should be defined as any area to be restored visible in the patient's smile. The charge or immediate function has as a prerequisite the need for the present implant primary stability in your installation. Thus, to maintain the gingival architecture, the understanding of biological principles governing is essential remodeling, as well as alveolar bone soft tissue [1-3].

The gingival contour also has great importance in aesthetics and is connected to individual anatomical characteristics: According to the lip line, the gingival tissues can be exposed during facial expressions. When the gum is attacked by the metabolic products of the components of plaque bacteria, appear modifications resulting from inflammation of the affected areas, causing changes in color and gingival contour. The health, color, and texture of the gingival tissues are critical to the long-term success and the aesthetic value of treatment [3-5].

In this context, it has become essential to proper clinical evaluation, providing correct surgical planning and prosthetic rehabilitation aiming at excellence. This aesthetic improvement is directly related to the anatomical context of the region, both soft tissue like the hard, and the use of important gingival ceramics for the correction of certain clinical situations [6-9].

When properly planned use establishes a certain predictability, with satisfactory characteristics in its aesthetics and function, thereby correcting certain situations such as black spaces due to the loss of interdental papillae, and improving areas with significant bone resorption [8,9].

Moreover, changes in anatomical structures, especially the maxilla become challenging rehabilitation implants as an alternative to this tilt to obtain the best results. Thus, the use of an intermediate bent to make possible prosthetic rehabilitation is necessary [10]. Hence, increasing functional demands and aesthetics require that the prosthetic rehabilitation establish a harmonic gingival contour of the tooth or implant adjacent to the interproximal full papilla gingival regular concave arc and thickness and color of the satisfactory soft tissue, especially as related to upper front teeth [10,11].

The challenge is to get the relationship between the prosthetic crown and the surrounding tissues, knowing that a well-applied ceramic restoration can mimic any dental unit. However, to achieve great results in terms of aesthetics and the natural contour of the gingiva around prosthetic implants many studies are still needed. The red components of aesthetics cover not only the color, thickness, and harmonic contour of the gingival tissue but also the presence of interdental papillae [1,2,10,11]. Thus, factors such as the height of the crestal bone, periodontal biotype, the dental restoration format, the point of contact, and the implant position in the arch, play a significant role in the location and quality of interproximal papilla. The papilla plays a unique role in protecting periodontal protection including the alveolar bone crest, with protective action against microorganisms and food [11,12].

The rehabilitation treatment with dental implants has shown high predictability and high success rate, making this mode an option of choice for the treatment of tooth loss. Moreover, the biological and mechanical performance of the treatment is not always accompanied by a satisfactory aesthetic result [12,13]. Reverse planning has been considered essential in the predictability of implants, guiding the treatment for functional and aesthetic results more satisfactorily, however, the literature showed few articles showing measurable and reproducible aesthetic parameters for rehabilitation with implants [13-15].

Therefore, the present study aimed to review the literature and discuss the major factors supporting the red aesthetic excellence before and after the rehabilitation of former regions, and the use of dental implants.

Methods

Study design

The present study followed the international systematic review model, following the rules of PRISMA (preferred reporting items for systematic reviews and meta-analysis). Available at: http://www.prisma-statement.org/?AspxAutoDetectCookieSupport=1. Accessed on: 04/12/2024. The methodological quality standards of AMSTAR-2 (Assessing the methodological quality of systematic reviews) were also followed. Available at: https://amstar.ca/. Accessed on: 04/12/2024.

Data Sources and Research Strategy

The literary search process was carried out from March to June 2024 and was developed based on Scopus, PubMed, Web of Science, Lilacs, Ebsco, Scielo, and Google Scholar, covering scientific articles from various to the present. The health science descriptors (DeCS/MeSH Terms) were used: *"Red Aesthetics. Gingival aesthetics. Implant dentistry. Implant rehabilitation"* and using the Boolean "and" between the MeSH terms and "or" between historical discoveries.

Study Quality and Risk of Bias

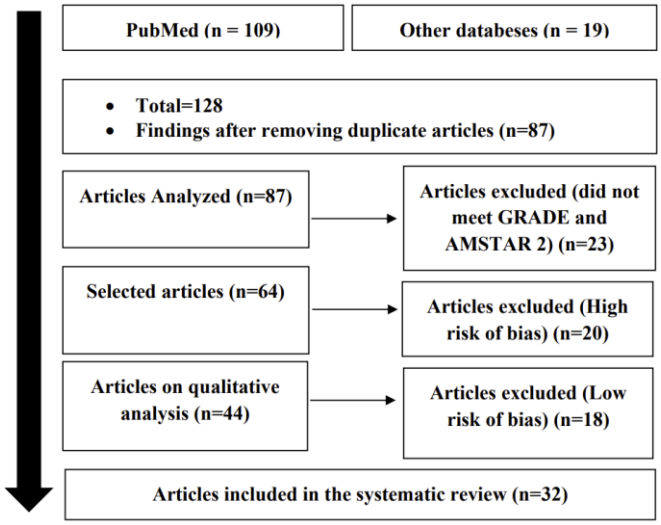
Quality was classified as high, moderate, low, or very low in terms of risk of bias, clarity of comparisons, precision, and consistency of analyses. The most evident emphasis was on systematic review articles or meta-analyses of randomized clinical trials, followed by randomized clinical trials. The low quality of evidence was attributed to case reports, editorials, and brief communications, according to the GRADE instrument. The risk of bias was analyzed according to the Cochrane instrument by analyzing the Funnel Plot graph (Sample size versus Effect size), using the Cohen test (d).

Results and Discussion

Summary of Findings

A total of 128 articles were found that were subjected to eligibility analysis, with 32 final studies being selected to compose the results of this systematic review. The studies listed were of medium to high quality (Figure 1), considering the level of scientific evidence of studies such as meta-analysis, consensus, randomized clinical, prospective, and observational. The biases did not compromise the scientific basis of the studies. According to the GRADE instrument, most studies showed homogeneity in their results, with X^2=81.5%>50%. Considering the Cochrane tool for risk of bias, the overall assessment resulted in 20 studies with a high risk of bias and 23 studies that did not meet GRADE and AMSTAR-2.

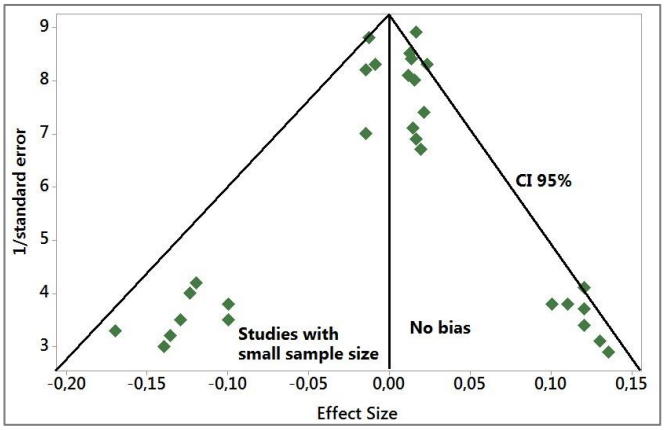
Figure 1. The article selection process by the level of methodological and publication quality.



Source: Own authorship.

Figure 2 presents the results of the risk of bias of the studies using the Funnel Plot, showing the calculation of the Effect Size (Magnitude of the difference) using the Cohen Test (d). Precision (sample size) was determined indirectly by the inverse of the standard error (1/Standard Error). This graph had a symmetrical behavior, not suggesting a significant risk of bias, both between studies with a small sample size (lower precision) that are shown at the bottom of the graph and in studies with a large sample size that are presented at the top.

Figure 2. The symmetric funnel plot suggests no risk of bias among the small sample size studies that are shown at the bottom of the graph. High confidence and high recommendation studies are shown above the graph (n=32 studies).



Source: Own authorship.

Major Findings and Considerations

The presence or absence of keratinized gingiva, both around teeth and around implants has generated much discussion in the literature. Some authors teach that the presence of keratinized gingiva is important to stabilize the gingival margin preventing its displacement and probable bacterial invasion. Others claim that if there is no plaque the amount of keratinized gingiva is not relevant [1-4]. Thus, although there are no reports in the literature that discuss the variables that could influence the aesthetic rehabilitation with implants in a cleft area that affects the alveolar ridge grafted and the degree of patient satisfaction with this type of rehabilitation. The study of all these variables can contribute decisively to indicating whether or not the rehabilitation of the area with unit prostheses on dental implants [4,5].

In this context, a study carried out by the authors Baghiana et al. (2022) [3] evaluated the RED ratio and the golden ratio among 106 participants (50 men and 56 women), aged 18 to 25 years. The RED ratio was noted to be inconsistent as it progressed distally. It was observed that the Golden Ratio was at 6-29% of the existing population of individuals. Thus, the emergence of indices that assess objectively the outcome of treatment, including the red aesthetics of scale; and aesthetics of the measurement index of implant crowns and adjacent soft tissues, collaborate as important tools for assessing the degree of red aesthetic [7]. Thus, a new stage in implant dentistry was initiated through the development of the white and red aesthetic index Buser, Martin, and Belser (2004) which measures the objective results in different stages of treatment, from planning to the measurement of the outcome of treatment [16].

In this sense, five questions are evaluated in red aesthetics (1) papilla mesial (2) distal papilla, (3) the curvature of buccal mucosa, (4) Level of facial mucosa, and (5) curvature of the root/color and texture of soft tissue in facial appearance of the implantation site, assigning a score of 2, 1 or 0 for all five parameters to red aesthetic [8,9]. All teeth were compared to their counterpart. A score of 2, 1, or 0 was assigned to each variable, thus a score of 10 denoted a crown on the implant and an excellent score of 6 acceptance limit for clinical treatment. Moreover, when the related red and white aesthetic index score was 20 maximum, determined perfectly; excellent overall aesthetic result if the total score obtained is 17; satisfactory aesthetic overall result if the sum is 15, and 12 as the threshold of clinical acceptance [9].

In this system, current studies are directed to explore the thickness of the mucosa would have similar implications around dental implants [9]. The absence of keratinized gingiva was also associated with increased buildup of plaque, bleeding on probing, gingival inflammation, and recession. These findings suggest that the thickness of keratinized mucosa can determine the future dynamics of the soft tissues surrounding

dental implants [2,10].

Thus, it has been reported that the presence or reconstruction of keratinized tissue around implants can facilitate restorative procedures, to promote the aesthetic and still allow the maintenance of the oral hygiene routine without irritation or discomfort to the patient [11,12]. Moreover, according to a recent consensus of the International Oral Implantology Congress, the success of the implants must meet both functional and aesthetic criteria. Based on these findings, gingival augmentation procedures are indicated in clinical practice with plaque control purpose, patient comfort, and better aesthetic results, especially when in association with prosthetic treatment [13].

The width of the central incisor is multiplied by the desired red ratio to determine the point of view frontal width of the lateral incisor. The values of red ratios used are between 60% and 80% [8-13]. The resulting lateral incisor width is multiplied by the same red ratio to obtain the desired front view of the canine. Thus, a certain mathematical formula to calculate the upper central incisor width for any red ratio is determined by measuring the front view width between the distal aspect of the upper canine teeth which is (a front view of the previous six teeth) / 2 (1 RED2 + RED +) = central incisor width [14].

The use of ceramic gum has been an alternative for the correction of defects or replacement of the protective periodontium, often lost by extensive bone resorption present in certain areas. Thus, you can replace the need for surgery possible, since this may be impractical for the patient much discomfort due to the increase in the cost [14,15]. Thus, using the rehabilitation gingival ceramic has the advantage of reducing the cost, labor time, and discomfort for the patient and the possibility of air sealing, by promoting improvement in the patient's phonation above [16]. It also promotes improvement in aesthetics, it eliminates the black spaces present in patients with loss of papillae interproximal [17]. Even in this context, the acquisition of aesthetic excellence in the rehabilitation of the anterior maxilla is a factor of extreme difficulty, as in the work of Belser [17], in which none of the 45 cases evaluated obtained a maximum score of 20, and measured the highest value of 18. Buser et al. [16] found a value of 16.75.

The emergence of various indices to measure the aesthetic result provided objective data to evaluate the diagnosis, planning, execution, and final evaluation of rehabilitation. Belser, Buser, and Higginbottom reported that the use of implants in the esthetic zone was well documented in the literature, but no well-defined aesthetic criteria [16,17]. According to Belser et al. [16] it can be seen that it is possible to perform a treatment associated with the white and red aesthetics without breaking the tissue integrity and return to the patient the structure lost without causing losses of the functional and aesthetic point of view of obtaining good results over time.

Rosa (2012) [18] reported that the progressive regression of the alveolar bone occurs shortly after extraction and that in a period of 6 to 12 months buccolingual or horizontal reduction crest is 4mm on average, to about 50 % of the initial volume and that the apicocoronal direction, or vertical, is on average from 2 to 3.0 mm. It found that the socket also presents dimension losses on the inner portion around 4 to 5.0 mm, corresponding to 50 % of its initial width. Among several limitations observed in the planning of cases in the cosmetic area, another important factor to be considered is that after tooth extraction alveoli typically have dimensions larger than the implant, which conducting regenerative procedures is necessary, including the use of synthetic bone substitutes such as Bio-Oss ® (Geistlich Pharma, Switzerland), to keep the dimensions of the socket and the appropriate gingival contour.

In another condition, the socket can still have a loss of vestibular wall, in this case, we can make use of autogenous bone, cancellous cortical, and the tuberosity region, as in the technique Dentoalveolar Immediate Restoration, called RDI [19]. These regenerative procedures can often be associated with the use of tissue grafts as advocated by Joly et al. [20] (2013), to an excellent architecture of peri-implant gingival tissue.

Together with the above information, we must involve the installation of the immediate temporary prosthesis with properly adjusted occlusal contacts, which in addition to optimizing the comfort and aesthetics of the patient, allow the preservation and maintenance of tissue architecture favoring the final result of the work [20,21]. These treatment options aim to give a better cosmetic result for the peri-implant tissues, which should function as a frame of the prosthetic crown to be installed after the osseointegration [22-26].

Franchiscone et al. (2012) [21] reported that the prosthesis on an implant only achieves real aesthetic excellence if it is in line with the gum tissue that encases it. Within this complex context of aesthetic excellence, the key topic is the preservation of peri-implant tissues to optimize restorative treatment. Dental implants have brought current Dentistry unparalleled advances in aesthetic and functional rehabilitation of patients complete or partially edentulous [27-29].

On the other hand, they also brought doubts regarding the survival of the implants, especially when related to the amount of keratinized mucosa and peri-

implant health [25-28]. In this context, recent literature data show that a mucous range keratinized less than 2.0 mm promotes plaque buildup, peri-implant bleeding, and recession of soft tissue [30-32].

Some other studies have reported that the implants can survive without a range of appropriate keratinized gingiva, but the goal of the current implant is to ensure that the implants, and osseointegrated, maintain their state of full health, function, and aesthetics, especially to gingival esthetics [1-3]. Taking into account differences between the interface of the soft tissues around dental implants compared to natural teeth, one can question whether the peri-implant keratinized mucosa is necessary or at least beneficial to the peri-implant health, as well as if the minimum 2.0 mm keratinized mucosa recommended for natural teeth are also applicable to dental implants [3-5].

Thus, several factors may influence the need for an appropriate range of keratinized mucosa [17-19]. Regarding sanitation, the lack of this can create a less capable of mouthwash condition and more susceptible to irritation and discomfort during routine procedures, as well as the clinical features of gingival inflammation and bleeding on probing [28-31]. On the other hand, sufficient keratinized tissue areas can offer more resistance to the forces of mastication and the friction occurring during oral hygiene procedures [28-30]. Another important factor related to keratinized mucosa is the gingival recession in the peri-implant region. Studies have shown that the width and thickness of the peri-implant mucosa had a significant negative correlation with the gingival recession, demonstrating a range of less than 2.0 mm of keratinized tissue increased the risk of recession and exposure of the threads of the implants [28-32].

The presence of keratinized tissue around the implants also offers the advantage of ease of molding during rehabilitation, the lower probability of tissue collapse above the head of the implant, and facilitating the aesthetic [29], as shown similar to tissue surrounding teeth; Thus, the stability of the soft tissue around the implant tails is an important factor to achieve optimal esthetic result. In case of a lack of soft tissue and areas of recession, grafting techniques can be displayed, and despite the discomfort provided by surgical techniques, these positive results show significant gains and tissues, providing comfort and aesthetics appropriate to the patient [26-30].

There are several techniques available to increase the gingival thickness as the flap positioned apically, the flap positioned laterally, the free gingival graft, the flap of partial thickness positioned apically, or connective tissue graft [27]. It is important to note that the keratinized mucosa is not decisive in isolating the front implants from bacteria in the oral cavity [2,3]. It is noteworthy that the vast majority of patients seeking rehabilitation treatment with dental implants lost their natural teeth because of periodontal disease induced by plate [3,4] bacteria. Thus, patients rehabilitated by implant prostheses must be within a plaque control program and constant professional guidance regarding hygiene techniques and oral therapy, which will contribute to the clinical success of rehabilitation treatment [4,5].

Within the limits of this clinical case, it can be concluded that the free gingival graft is a predictable and easy technique for achieving an increased range of keratinized mucosa peri-implant mucosa prosthesis protocol; But hygiene techniques and professional oral

physiotherapy carried by the patient are fundamental to the clinical success of the rehabilitation treatment [1-4].

Conclusion

It was concluded RED 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. A correct treatment plan to meet the restorative and surgical protocols appropriate, thus being able to achieve satisfactory results is required.

CRediT

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