

Esthetics in Implant-Supported Prosthesis: A Literature Review

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Esthetics is important for success of implant-supported prostheses. This study aimed to review esthetics concepts for implant treatment. Research in the PubMed database included studies published from 1995 to 2010 with the keywords *implant esthetics*, *implant-supported prostheses*, and *esthetics*. Forty-five studies were evaluated regarding the presurgical planning, surgical phase, and temporary and final restoration phases. It was concluded that esthetics in implant-supported prostheses results from a multidisciplinary approach from planning until insertion of the final restoration.

Key Words: *dental implant, implant-supported prosthesis, esthetics*

INTRODUCTION

Recently, the success of osseointegration of a dental implant is not enough for treatment success because esthetics of restoration are important for patient satisfaction.^{1,2} Because of this, some authors have highlighted the importance of presurgical planning,³ while other authors have focused on adequate implant positioning to provide a natural appearance to the implant-supported restorations.^{4,5} Thus, professionals should consider that the parameters of dental and gingival esthetics are essential for creating a smile in harmony with the patient's face and expectations.¹

According to Cooper,⁶ esthetics depend on some factors that should be evaluated during diagnosis to reveal and overcome previous limitations of the treatment. After this phase, the implant can be safely positioned for prosthesis insertion according to the biological distance and satisfactory architecture of the peri-implant tissues.

As several limitations result from tooth loss, Jovanovic⁷ presented the esthetic bone graft to recover bone height and width since the surrounding bone tissue supports the soft tissue.⁸ Thus, not only proper contour of bone tissue but also adequate manipulation and conditioning of soft tissue are important for treatment esthetics.^{8,9} In addition, Chee and Jivraj¹ demonstrated that the greater the loss of soft and bone tissues, the greater the difficulty of providing satisfactory esthetics.

Thus, considering the importance of obtaining restorations integrated to the facial-dental complex with regard to function and esthetics,^{9,10} the aim of this study was to present concepts for the esthetics of treatment with implant-supported prostheses through a literature review.

MATERIALS AND METHODS

The literature review was conducted through the PubMed database including case reports, classical studies, and comparative studies published from 1995 to 2010 with the keywords *implant esthetics*, *implant-supported prostheses*, and *esthetics*.

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RESULTS

The research found 510 studies. After analysis of the titles and abstracts, 45 studies were selected for their association with the aim of the present study. Although the main search focused on studies published from 1995 to 2010, some older studies were included as classical studies presenting basic concepts about esthetics in implant treatment.

Table 1 presents the studies evaluated in this literature review that were divided into 3 categories: treatment planning including general esthetical concepts, surgical phase, and restoration phase.

DISCUSSION

Presurgical planning

According to Askary,⁸ evaluation of the dental-gingival complex before surgery is important for adequate planning. The literature suggests that diagnosis is more important than implant design or abutment type to provide function and esthetics.^{37,44} Similarly, Levine² stated that the clinical evaluation of the edentulous region should consider the patient's smile line, gingival morphology, interarch relation, condition of the adjacent teeth, condition of the supporting tissues, and radiographic examination. After evaluation of these factors, the surgical technique, implant length, and

provisional and final restorations could be planned.¹³

The amount of bone tissue is critical for treatment success because bone deficiency may lead to gingival recession, loss of papilla, and inadequate implant positioning.¹³ The study by Tarnow et al⁴⁵ demonstrated that a maximum distance of 5.0 mm between the alveolar crest and the contact point should remain to maintain the papilla. Thus, when loss of bone tissue or keratinized mucosa occurs,¹³ regenerative techniques should be planned during this treatment phase,⁸ such as guided bone regeneration and grafts of bone tissue and/or soft tissue.³⁷

The analysis of the images obtained through radiography or computerized tomography allows evaluation of bone dimension and contour of the residual ridge to guide the planning of implant positioning.^{26,37}

The tissue biotype is classified into 2 categories^{8,36}: thin and thick. The thick biotype exhibits a thick and plane bone structure associated with an extensive band of attached gingiva. The thin biotype presents a fragile tissue and thin bone structure. When occlusal trauma occurs, the thick periodontal biotype responds through periodontal pocket formation, while the thin biotype reacts with formation of recessions that may compromise the esthetics of implant-supported restorations.

TABLE

Studies evaluated in the present literature review and divided into 3 categories: treatment planning, surgical phase, and restoration phase

Treatment Planning	Surgical Phase	Restoration Phase
Askary ⁸	Albrektsson et al ¹¹	Al-Harbi ¹²
Bashutski and Wang ¹³	Auty and Siddiqui ¹⁴	Al-Sabbagh ¹⁵
Belser et al ¹⁶	Becker et al ¹⁷	Andersson ¹⁸
Chee and Jivraj ¹	Branemark ¹⁹	Brodbeck ²⁰
Chee ²¹	Buser and von Arx ²²	Chee ²³
Cooper ⁶	De Rouck et al ²⁴	De Rouck et al ²⁵
Duncan and Westwood ²⁶	Ericsson et al ²⁷	Glauser et al ²⁸
Gehrke et al ⁹	Gomes et al ²⁹	Heydecke et al ³⁰
Jansen and Weisgold ³	Oh et al ³¹	Kohal et al ¹⁰
Jovanovic ⁷	Polizzi et al ³²	Kourtis et al ³³
Levine ²	Potashnick ³⁴	Shibli and d'Avila ³⁵
Olsson and Lindhe ³⁶	Somanathan et al ³⁷	Tan and Dunne ³⁸
Parel and Sullivan ⁵	Tarnow et al ³⁹	Yildirim et al ⁴⁰
Shotwell ⁴¹	Zetu and Wang ⁴²	
Somanathan and Simunek ⁴³		
Spielman ⁴		
Sullivan ⁴⁴		
Tarnow et al ⁴⁵		

When the space available for rehabilitation is insufficient, orthodontics should be considered during planning to improve the position of the remaining teeth as well as orthodontic extrusion to increase the papilla height.^{8,21,23,37}

Askary⁸ reported that the number of teeth to be replaced can also influence the planning regarding esthetics. Thus, a reduced number of implants for a multiple-implant rehabilitation may favor esthetics, resulting in better architecture of the peri-implant soft tissue and reproducing the papilla with pontics.

The rehabilitation of the anterior maxillary region should also consider the patient's smile line since gingival exposure is higher with a high lip line, while less than 75% of the incisors are exposed with a low lip line.¹

Considering all factors described previously, a diagnostic waxing⁸ should be reproduced to visualize the final prostheses in relation to the remaining structures. Based on this waxing, it will be possible to fabricate a surgical guide to improve the 3-dimensional position of the implants during the surgical phase^{16,41} since the prosthetically driven implant placement enhances integration and harmonization of the final restoration.³³

Surgical phase

The surgical protocol may also influence the esthetic result of the treatment with implants. Recently, the conventional protocol that established a period of 3 to 6 months for osseointegration before loading^{11,19} has been replaced by other techniques such as the 1-step surgical technique,¹⁷ implant insertion immediately after exodontia,³² and immediate loading with provisional restoration.^{27,29}

Although the implant insertion immediately after exodontia presents with a high success rate in the literature,¹ the traumatic manipulation of the tissue may jeopardize the esthetics of the restoration. Similarly, the late insertion of the implant may increase bone resorption and generate deficient esthetics.⁸ However, it is important to highlight that the presence of pathologies, infection, and bone defect in the region counterindicates the immediate insertion of the implant.¹³

The literature also suggests the flapless surgical technique to provide a better esthetic result than the flap technique,^{14,31} since it maintains the

blood support and causes less trauma.²⁴ However, this technique avoids direct visualization of bone defects that may generate complications.¹³ Thus, the flapless surgical technique should be guided by a virtual planning²⁴ or be associated with radiographic and/or tomographic analyses.¹

According to Belser et al,¹⁶ 1 mm of bone tissue should remain in the vestibular region of the implant to create a proper emergence profile. However, Potashnick³⁴ suggested that when the implant is positioned in the palatine region because of limitations, the implant should be positioned 1 mm apically for each 1 mm of palatal displacement.

Besides the bone tissue, manipulation of the soft tissue during surgery is also important to obtain a natural implant-supported restoration. Thus, the incision should be minimally traumatic to avoid recession in adjacent teeth and maintain the integrity of the papilla and interradicular bone tissue. In addition, the flap closure should be conducted under minimum tension to avoid complications in the soft tissue.⁸

Somanathan et al⁴³ stated that maintenance of the subjacent bone tissue is the best way to create gingival papilla. The same authors reported that the papilla maintenance depends on the distance between the implants and the relation to the adjacent teeth as well as the subgingival contour of the implant-supported restoration.

Considering the implant positioning, the 3-dimensional placement must be related to the final prosthesis insertion.³⁷ Some studies demonstrated that the implant should be inserted at 1.5 mm to the adjacent tooth, 3.0 mm to adjacent implants, and 2.0–3.0 mm apically to the cemento-enamel junction.^{22,39,42} The insertion of implants close to adjacent teeth and implants can cause resorption of the alveolar ridge and reduction of the papilla height, which generates longer crowns.^{1,37}

Bashutski and Wang¹³ and Chee and Jivraj¹ stated that it is easier to maintain the papilla with single than multiple implants since the natural tooth does not present the resorption and bone remodeling that occur after implant insertion. For rehabilitations with multiple implants, Askary⁸ and Chee and Jivraj¹ suggested a reduced number of implants to enhance esthetics through the pontics between the implants.

Provisional restoration

Askary⁸ affirmed that the provisional restoration is an important step in obtaining treatment esthetics because it creates an adequate emergence profile³⁷ and enhances the formation of papilla between the adjacent implants that will be maintained until the insertion of the final restoration.¹³ Furthermore, the provisional restoration guides the morphological development of the peri-implant mucosa and controls the design of the final restoration.^{6,33}

The provisional restoration used during the osseointegration period can be a removable denture, a fixed prosthesis bonded to the adjacent teeth, or a prosthesis supported by temporary implants. When removable dentures are used, it is important to relieve the surface in contact with the implants to avoid pressure during the healing period.^{8,13}

The study of De Rouck et al²⁵ demonstrated better papilla maintenance and less recession for restorations inserted immediately after implant insertion in comparison with restorations inserted later. According to the authors, these results demonstrated that the immediate insertion of implant-supported prostheses provides support to the peri-implant tissues, which is important for treatment esthetics.

Final restoration

The adequate selection of prosthetic components is important for esthetics with implant-supported prostheses.^{8,37} When esthetics was compromised during previous steps, some prosthetic adjustments can be carried out to minimize this limitation, such as selection of angulated abutments, fabrication of restorations with greater contact area, and use of gingival ceramic and ceramic abutments.^{12,15,20,35}

Although titanium presents biocompatibility and favorable mechanical properties,¹⁰ its color may compromise esthetics of the peri-implant tissue.^{10,30} This limitation stimulated the development of ceramics to fabricate abutments and crowns.^{18,28,40}

The evolution of components allowed the use of zirconia abutments to rehabilitate areas with a thin periodontal biotype or with implants inserted in the buccal region presenting risk of gingival recession¹³ since these abutments exhibit proper mechanical, biological, and esthetic properties.

The association of the abutment and the veneering material to fabricate the prosthesis should reproduce color, translucency, contour, and texture of the adjacent teeth.⁶ Thus, according to the study of Tan and Dunne,³⁸ optimum esthetics can be generated when the limitations of each case are evaluated to guide the correct selection of the components.

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