

Review Article

Aesthetics in implantology

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ABSTRACT

The field of dentistry has been transformed by osseointegrated implants, providing a dependable and lasting solution for patients who have lost teeth. These implants are now a highly successful and widely accepted treatment. Historically, the success of implant placement depended heavily on the quantity and quality of existing bone. However, with innovations like guided tissue regeneration (GTR) and new tools such as Osseo densification burs, it's now possible to place implants successfully even in areas with less-than-ideal bone. When placing implants in these more challenging locations, the focus extends beyond just functional success to include crucial esthetic considerations. These include the shape of the alveolar ridge contour, the health of the surrounding mucosa, the position of the crown margin, the crown form, the interdental spacing, how the occlusal surface design, the placement of the incisal edge positioning, how the lip supports, and the overall appearance of the smile.

Keywords: Osseointegration, Platform switching, Guided tissue regeneration

INTRODUCTION

It's tough to perfectly match the natural look of teeth with artificial ones, even with all the new materials out there.¹ There's no single scientific way to measure what "true esthetic harmony" really means in dentistry. Still, a lot of scientific research and clinical trials have focused on creating guidelines for achieving good esthetics. This has led to the development of different checklists and protocols that help dentists and lab technicians design the best possible dental work, always keeping the patient's preferences in mind.^{2,3} This article will dive into the esthetic considerations for crowns and fixed bridges that are supported by dental implants. The development of osseointegrated implants has given us a dependable and proven long-term solution for patients who've lost all their teeth. Because many different implant systems have a strong history of success, dentists now have a wide range of stable choices that can be customized for specific areas where teeth are missing. When restoring an implant, dentists have to carefully juggle function, esthetics, and the health of the tissues around the implant. You can't sacrifice

one of these for another. That means every step, from choosing the right patient and planning the treatment to actually carrying it out, is crucial for the overall success of the implant restoration.⁴

HISTORICAL BACKGROUND

While people have sought to improve their smiles for millennia-with ancient civilizations like the Egyptians and Mayans even attempting surgical tooth replacements as early as 600 A.D. The true revolution in modern dental implants began in 1952 with Branemark's groundbreaking work. This marked the start of the widespread use of osseointegrated implants, which are now fundamental to restorative dentistry for patients missing some or all of their teeth. Today, alongside essential functional considerations, the esthetic outcome of implant treatment is equally vital. Patients in the modern era no longer accept visible crown margins or mismatched shades in their implant-supported restorations. This shift reflects how implant dentistry has evolved from simply replacing teeth to meeting sophisticated esthetic demands, presenting new complexities for clinicians. Achieving truly optimal

esthetics can be challenging, and at times, exceedingly difficult. This article will therefore outline current clinical guidelines for esthetic implant therapy. It will emphasize key principles of peri-implant architecture, covering both the surrounding hard (bone) and soft (gum) tissues, and will also discuss potential complications that can arise in the highly visible "esthetic zone" of the mouth.

CONTEMPORARY CLINICAL PARAMETERS DIAGNOSIS AND TREATMENT PLANNING

A successful introductory patient visit should yield a comprehensive clinical record with good intraoral and

extraoral images, screening x-rays that may reveal potential abnormalities or aberrant anatomy, and flawless study casts (Table 1).

PRINCIPLES OF ESTHETIC THERAPY

Clinicians' expanding use of cosmetic restorative procedures has generated greater interest in the determination of esthetic guidelines and standards. The esthetic criteria can be broadly analysed through clinical parameters such as macroesthetics, miniesthetics, and microesthetics as proposed by Sarver & Ackerman (Table 2).⁵

Table 1: Esthetic clinical parameters diagnosis & treatment planning.

Photographs (extraoral/ intraoral)	Study casts	Clinical history	Radiographs
Oblique/facial/occlusal view	Maxillary and mandibular diagnostic models	Medical systemic diseases	IOPA
Rest position	Edentulous models	Dental history	Panoramic/PA
Region of interest	Articulated interocclusal record models	Extraoral analysis	CBCT Analysis
Movable activities-speech/smiling	Diagnostic wax-up	Intra Oral analysis	CBCT Analysis

Table 2: Esthetic criteria.

Macro esthetic design	Mini aesthetic design	Micro- esthetic design
Facial profile	Smile arc concepts	Incisor angulation
Lip fullness/length	Symmetry of smile	Emergence profile
Vertical projections	Malocclusion(crowding)	Height of the gingiva
Nasal projections	Anterior teeth-incisor display	Shade of tooth and spacing
ears	Transverse display	Triangular holes

Table 3: Esthetic criteria-pink &white score.

Pink esthetics	Score	White esthetics	Score
Mesial papilla	2	Tooth form	2
Distal papilla	2	Outline / volume	2
Curvature of facial mucosa	2	Color hue/value	2
Level of facial mucosas	2	Surface texture	2
Root convexity /soft tissue, Color, texture	2	Translucency/characterization	2
Maximum score	10	Maximum score	10

Table 4: Treatment complications in the aesthetic zone-etiology iatrogenic causes.

Iatrogenic causes	Anatomic causes
Selection at an inappropriate, oversized Implant (wide platform)	Horizontal bone deficiencies at the implant site
Inappropriate use of restorative implant components or materials for fabricating restorations	Vertical bone deficiencies at the implant site
Improper use or non-use of provisional restorations to shape the peri implant soft tissue	Vertical bone deficiencies at adjacent root surfaces
A surgical approach that over stresses the healing capacity of the tissue, leading to the resorption of the facial bone wall	Implant sites with multiple missing teeth leading to the placement of adjacent implants
Malposition implant entering a danger zone in a coronapical, mesiodistal or orofacial direction	Aberrant pathology

Clinical anatomic site analysis for ideal soft and hard tissue esthetics should include.⁶

Lip line esthetics (location of smile line high, medium/low; lip support & length) Gingival morphotype. (thin with high scallop vs. thick with shallow scallop). Interocclusal relationship (occlusal plane, horizontal and vertical overlap) status of tooth to be replaced and adjacent dentition (crown integrity, endodontic and peri odontal status). Status of the site and adjacent soft tissues (excessive gingival display/gummy smile or inadequate soft tissue because of gingival attachment loss resulting in gingival recession, gingival asymmetry, or a mucogingival problem).

Status of the site's hard tissues or bony deficiencies in a horizontal or vertical dimension that may require soft and/or hard tissue augmentation prior to placing an implant in its ideal prosthetically driven position. Radiographic status (position and axis of adjacent roots, radiolucency in the alveolar bone, vertical bone height), root length of the evaluated tooth, if deemed hopeless and assessment of the level of a root fracture or resorptive lesion of a hopeless tooth.

HARD TISSUE AESTHETICS

Strategies to achieve optimal hard tissue architecture involve the use of bone grafting materials, adjustments in implant loading and placement timing, innovative implant designs, and strategic implant positioning. Commonly practiced and effective hard tissue augmentation techniques include atraumatic tooth extractions, ridge preservation using bone grafts and guided tissue regeneration, immediate implant placement, and partial extraction therapies like socket shield technique. Other advanced procedures include flapless implant surgery, ridge augmentation with autogenous bone grafts, and distraction osteogenesis.⁷

For the reconstruction of more extensive bony defects, traditional approaches often incorporate autologous, allogeneic, or xenogeneic bone grafts through guided bone regeneration. These may be supplemented with biological agents and growth factors to enhance regenerative outcomes.⁸ The technique of guided local tissue regeneration has the following applications:

Filling bone defects before the implantation procedure.⁹ Initial increase of ridge width, with secondary implantation.^{10,11} Increase of ridge width with immediate implant placement.^{12,13} Direct submucosal implantation.¹⁴ Direct transmucosal implantation.^{15,16}

THE CROWN MARGIN

One of the key challenges prosthodontists faces when restoring teeth in the esthetic zone is preventing the visibility of metal margins while also minimizing the risk of bacterial niche formation. A common solution to meet

esthetic expectations is to position the implant components slightly below the mucosal level, effectively concealing them.¹⁷ However, clinical practice presents specific challenges that require thoughtful management, which can be addressed through the following strategies.

Positioning the implant below the mucosal margin. Utilizing standard cone or full-body titanium components from systems like ITI, combined with custom abutments. Slight over contouring with a veneering material that overlaps and conceals the margins, especially in less visible areas. Ensuring patients follow a meticulous oral hygiene regimen. Implementing a regular recall and maintenance schedule

These measures are essential to preserve peri-implant tissue health and ensure long-term esthetic and functional stability.¹⁸

CROWN FORM

Replicating a natural tooth with a dental implant, especially in the front of the mouth, is difficult for several reasons. First, the diameter of a dental implant rarely matches that of a natural tooth. Second, an implant's circular shape doesn't mimic the natural way a tooth emerges from the gums, making it harder to achieve good esthetics. Finally, there needs to be enough space between the upper and lower teeth (interocclusal space) to allow for proper crown design and contouring, so the final restoration looks like a natural tooth.

INTERDENTAL SPACE

Implants require careful positioning, as sufficient spacing between implants and adjacent natural teeth is vital for their long-term success. Every implant system has its own specific guidelines for ideal placement, often verified in the mouth with a surgical guide. Furthermore, the design of the spaces between teeth must allow for easy oral hygiene access without negatively affecting speech or appearance.¹⁸

OCCLUSAL SURFACES AND THE INCISAL EDGES

The occlusal surfaces and incisal edges of implant restorations are designed to closely resemble those of natural teeth. Material selection is guided by esthetic demands and the amount of available space. In screw-retained prostheses, the location of the occlusal screw access may sometimes compromise esthetics. This issue can be addressed by sealing the access with a resin or ceramic inlay to restore both function and appearance.

SOFT TISSUE AESTHETICS

The success of esthetic outcomes around implants largely depends on the patient's unique anatomy. This includes factors like the natural position of their teeth, the shape and

biotype of their gum tissue, the form of their teeth, and the level of their jawbone.¹⁹

To enhance these esthetic results, implant dentistry frequently uses several soft tissue management techniques. These range from minimally invasive procedures that reduce trauma to preserving the tooth socket after extraction to maintain the natural gum contour. Techniques like platform switching and specifically designed esthetic flap techniques are also employed. Improvements in how soft tissue is closed during the second stage of surgery have led to better surgical visibility and less scarring. Furthermore, connective tissue grafts, particularly inlay grafts, are commonly used to add volume. Onlay grafting is also used to increase the band of tough, attached gum tissue and prevent further gum recession.

In the anterior region, developing a natural-looking emergence profile has become critical for the success of implant restorations. This is because achieving a harmonious blend of hard and soft tissue contours is essential for mimicking the appearance of natural teeth. After tooth extraction, the anatomical basis for true gingival papillae—normally located just coronal to the cemento-enamel junction—is lost.²⁰ This often results in compromised esthetics in the visible zone due to the altered gingival contours. In some cases, remodelling of the papilla has been observed up to three years after prosthetic placement. However, in patients with thin biotype mucosa and narrow ridges, the metallic components of the implant may become visible, leading to esthetic failure. Ridge augmentation is recommended in such situations. Connective tissue grafts can also be used to mask exposed implant surfaces. Although plastic surgical procedures to reconstruct papillae have been described, their predictability remains uncertain.²¹

In cases where significant soft tissue volume is missing, gingival-coloured ceramics may be used to simulate the papillae. Other restorative options include ceramic and resin veneering to improve the esthetic outcome.²²

LIP SUPPORT

Reconstructing lost tissue is essential to restore proper lip support, facial profile, function, esthetics, and phonetics. Bar-retained restorations and acrylic-veneered Brånemark prostheses are effective options for achieving ideal lip support in suprastructures. Advances in bone reconstruction techniques, combined with technical innovation, have significantly contributed to the successful replacement of missing hard and soft tissues, resulting in improved and predictable esthetic outcomes

SMILE LINE

Smile line is a critical element in assessing a patient's esthetic appearance. Comprehensive evaluation, including the use of wax mock-ups and digital recordings, offers

valuable insights that aid in accurately designing the final prosthetic suprastructure.²³

RATIONALE OF PERI-IMPLANT ARCHITECTURE

The development of the peri-implant zone which primarily comprises of the crestal bone and the surrounding healthy soft tissue are considered to be of paramount necessity for the long-term success of implant-supported restorations. Factors governing the peri-implant zone esthetics include the following.

Peri-implant marginal gingiva, interproximal distance, peri-implant papilla, tooth form and shape, biologic width, gingival biotype, platform switch concept, tooth position, abutment disconnection and microlesion, type of gingival scallop, crestal bone height, amount of keratinized tissue

The evaluation of the aesthetic success of the peri-implant architecture is determined by the white aesthetic score and pink aesthetic score.

ESTHETIC CRITERIA

The esthetic evaluation of implant crowns in the anterior region involves both "white" and "pink" esthetic considerations, incorporating principles such as the golden proportion and the balance of soft tissue ("red") elements. The pink esthetic score (PES), introduced by Fürhauser et al, and the white esthetic score (WES), proposed by Belser et al., serve as standardized tools for assessing the esthetic integration of implant restorations (Table 3).^{24,25}

The pink esthetic score evaluates soft tissue esthetics based on several parameters: mesial and distal papillae, soft tissue level, tissue contour, alveolar ridge deficiency, as well as the color and texture of the peri-implant soft tissue. Each of these factors is scored on a scale of 2 to 0, where 2 indicates the most favorable outcome and 0 represents a poor result. A maximum score reflects an ideal match between the peri-implant soft tissue and the corresponding natural reference tooth.

PROVISIONALIZATION

The provisional restoration plays a vital role in the overall treatment plan, as it allows for the evaluation and refinement of both function and esthetics using a material that is easily adjustable. In implant rehabilitation, previsualization serves multiple purposes: it enhances esthetics, maintains masticatory function, and preserves the necessary space. More importantly, it helps guide and stabilize the peri-implant hard and soft tissues by precisely shaping the restorative material positioned between the implant shoulder and the visible supragingival portion of the prosthesis.

Through the fabrication and adjustment of the provisional restoration, both the clinician and the patient have the

opportunity to gradually shape the surrounding tissues, improving contours and achieving esthetic harmony. Once the functional surfaces, restorative contours, soft tissue margins, and the dento-gingival complex are optimized and approved by both clinician and patient, the case can then proceed to the fabrication of the final definitive restoration.²⁶

TREATMENT COMPLICATIONS IN THE AESTHETIC ZONE

Esthetic failures in implant dentistry are most often the result of incorrect implant positioning or the selection of an unsuitable implant.²⁷ While treatment complications can vary from prosthetic component fractures to temporary inflammatory conditions-this article focuses specifically on potential complications within the esthetic zone (Table 4), where failure may occur solely due to esthetic concerns. Many of these issues can be avoided through thorough pre-surgical planning, careful execution during the surgical phase, and precise management during the prosthetic phase

CONCLUSION

The primary objective in implant dentistry is to recreate gingival and surrounding structures that appear both natural and aesthetically pleasing. Achieving optimal esthetic results relies heavily on refining techniques at every stage-pre-prosthetic, pre-implant, and prosthetic. In today's evolving landscape of implant therapy, creating an implant-supported restoration that contributes to a harmonious, attractive smile demands a comprehensive esthetic assessment, an integrated treatment approach, and meticulous execution of each planned step.

This review highlights the critical role of soft tissue or "pink" esthetic management in achieving visual excellence in implant rehabilitation. By embracing a modern, holistic view of treatment planning, clinicians can better align implant therapy with patient-specific esthetic goals. Looking ahead, advancements in digital technology hold great promise for enhancing esthetic outcomes. Innovations such as software-based evaluation of clinical and biological parameters, virtual implant placement planning, and predictive modelling of prosthesis design can significantly improve precision and predictability in implant esthetics.

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REFERENCES

1. Fischer J. Esthetics and prosthetics: an interdisciplinary consideration of the state of the art. 1999.
2. Karrer M. Das Schöne, das Gesicht und die Zähne: Blicke in die Ästhetik. Dtsch Zahnärztl. 2002(57):515-25.
3. Sacher P, Rinn LA, Kopp FR. Ästhetische Richtlinien für die Rekonstruktive Zahnheilkunde. Berlin: Quintessenz. 1980.
4. Misch CE. Contemporary implant dentistry. Implant Dentistry. 1999 Jan 1;8(1):90.
5. Sarver DM, Ackerman MB. Dynamic smile visualization and quantification: Part 2. Smile analysis and treatment strategies. American J Orthodon Dentofac Orthop. 2003;124(2):116-27.
6. Levine RA. Soft tissue considerations for optimizing implant esthetics. Funct Esthet Restor Dent. 2007;1:54-62.
7. Dhir S. The peri-implant esthetics: An unforgettable entity. J Indian Soc Periodontol. 2011;15(2):98- 103.
8. Noelken R, Westphal L, Schiegnitz E, Al-Nawas B. Hard and soft tissue regeneration of severe peri-implantitis defects with the laser-assisted peri-implant defect regeneration technique: 3- year results. Int J Implant Dent. 2023;9(1):3.
9. Wiegel C, Bragger U, Sutter F, Hammerle CF, Lang NP. Prosthetics on implants crowns and bridges with new solid secondary parts: Dental Implant System. Switzerland med. 1994;104:757765.
10. Buser D, Bragger U, Lang NP, Nyman S. Regeneration and enlargement of jaw bone using guided tissue regeneration. Clin Oral Implants Res. 1990;1:22-32.
11. Nyman S, Lang NP, Buser D, Bragger U. Bone regeneration adjacent to titanium dental implants using guided tissue regeneration. A report of two cases. Int J Oral Maxillofac Implant. 1990;5:9-14.
12. Andresson T, Odman P, Widmark G, Waas A. Anterior tooth replacement with implants in patients with a narrow alveolar ridge form. A clinical study with a narrow alveolar ridge form. A Clinical study using guided tissue regeneration. Clin Oral Implants Res. 1993;4:90-8.
13. Jovanoic SA, Spiekermann H, Richter E. Bone regeneration around titanium dental implants in dehiscence defect sites; a clinical study. Int J Oral Maxillofac Implants. 1992;7:233-45.
14. Gelb DA. Immediate implant surgery: Three year retrospective evaluation of 50 consecutive cases. Inj J Maxillofac Implants. 1993;8:388-99.
15. Lazzara RJ. Immediate implant placement into extraction sites. Surgical and restorative advantages. Inj J Periodontal Res Dent. 1989;9:332-43.
16. Sarver DM, Ackerman MB. Dynamic smile visualization and quantification: Part 2. Smile analysis and treatment strategies. American J Ortho Dentofac Orthoped. 2003;124(2):116-27.
17. Sutter F, Schroeder A, Buser D. The new concept of ITI hollow cylinder and hollow screw implants: Part I: Engineering and design. Int J Oral Maxillofac Implants. 1988;3:161-72.

18. Lundqvist S, Haraldson T. Speech problems with osseointegrated implant bridges. *J Dent Res.* 1992;72:636.
19. Kois JC. Predictable single tooth peri-implant esthetics: five diagnostic keys. *Comp Contin Educ Dent.* 2001;22(3):199-206.
20. Renner RP. *An Introduction to Dental Anatomy and Esthetics.* Chicago: Quintessence; 1985.
21. Beagle JR. Surgical reconstruction of the interdental papillae: Case report. *Int J Periodont Rest Dent.* 1992;12:145-51.
22. 22 Bruggenckate CM, Krekeler G, van der Kwast WA, Oosterbeek HS. Palatal mucosa grafts for oral implant devices. *J Oral Surg Oral Med Oral Pathol* 1991;72:154-8.
23. . Studer S, Eppenberger J, Scharer P. Das an image processing computer system as a new diagnostics and communication means for the dental medicine swiss *Monatsschr Zahnmed.* 1992;102:1237-42.
24. Fürhauser R, Florescu D, Benesch T, Haas R, Mailath G, Watzek G. Evaluation of soft tissue around single-tooth implant crowns: the pink esthetic score. *Clin Oral Implants Res.* 2005;16(6):639-44.
25. Belser UC, Grütter L, Vailati F, Bornstein MM, Weber HP, Buser D. Outcome evaluation of early placed maxillary anterior single-tooth implants using objective esthetic criteria: a crosssectional, retrospective study in 45 patients with a 2- to 4-year follow-up using pink and white esthetic scores. *J Periodontol.* 2009;80(1):140-51.
26. Dwayne Karateew E. *Implant Provisionalization: The Key to Definitive Aesthetic Success.* Implant Aesthetics: Keys to Diagnosis and Treatment. 2017:337-52.
27. Buser D, Martin W, Belser UC. Optimizing esthetics for implant restorations in the anterior maxilla: anatomic and surgical considerations. *International J Oral Maxillofac Impl.* 2004;19(7):43-62.

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