

IMPLANT AESTHETICS – AN OVERVIEW

*Harshvardhini. N, ** Aparna Mohan, *** Giri Chandramohan, **** Allen Jim Hines

*Postgraduate Student, **Professor, ***Professor & Head of the Department, ****Reader, Department of Prosthodontics, Sree Mookambika Institute of Dental Sciences, Kanyakumari-629161 / Corresponding author: Dr. Harshvardhini. N, e-mail: harshvardhiniraj@gmail.com

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Abstract

Dental implant therapy is by far the closest replacement to natural teeth when compared to other fixed prosthetic alternatives. Aesthetic implant therapy enhances every aspect of oral implantology, thus evolving into a fundamental component of contemporary implant dentistry. Lately, significant advancements have been made, such as the development or regeneration of implant recipient sites through the stimulation of both soft and hard tissues, as well as the replication of sound peri-implant tissue architecture that are resistant to masticatory trauma and mechanical forces. Modern esthetic approaches require patient's preferences to be taken into consideration, and spontaneous addressal to their specific issues have become inevitable in modern aesthetic implant practice from a restorative sense. This review examines the key historical context surrounding dental implant aesthetics and outlines the various crucial elements that are necessary to guarantee a solid foundation to an aesthetically pleasing implant with stable anchorage. If aesthetic risk factors are to be identified and appropriately managed, then an interdisciplinary, systematic, prosthetically driven approach is required.

Keywords: osseointegration, platform switching, guided tissue regeneration.

Introduction:

More than ever, implant dentistry places a strong emphasis on the patient's overall appearance, which improves social interaction as well as the patient's sense of self-worth and confidence. This has resulted in the development of novel loading concepts, adaptable restorative options, complex implant designs, innovative, esthetic surgical techniques which are less invasive. As a consequence of this, dental implants are now employed with exceptional treatment success rates thanks to more precise surgical and biomechanical protocols. In other words, these ideas helped usher in a new era of clinical predictability which is an amalgamation of function with esthetics.

Titanium dental implants, which are used in contemporary dental care, have been shown to be secure and efficient in the longevity of esthetic implant therapies in well-controlled, long-term studies. Other dental materials include hybrid ceramics & zirconia implants. There is little research to support the general efficacy and durability of aesthetic therapeutical methods employed in anterior implant rehabilitation from a prosthodontic purview despite recent

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developments observed in the practices of many clinicians. Consequently, for esthetic implant therapy, a standard surgical and prosthetic protocol is required.

Historical background

Cosmetic dentistry has been practiced by ancient civilizations like Egypt for over four millennia. In the region of Central America, fine dark stones in the shape of teeth were discovered implanted within certain Mayan skulls around 600 A.D., suggesting surgical implants have played a significant role in the evolution of dentistry in substituting lost teeth. In 1952, Branemark started the current wave of implant usage. Osseo integrated implants are now a vital tool in the restorative dentist’s toolbox for treating patients who are either completely or partially edentulous, and in addition to function, aesthetics is given top priority.

Patients are currently considering visible crown margins or an inaccurate porcelain color match over an implant-supported prosthesis as an unsatisfactory treatment outcome because contemporary implant dentistry concepts have progressed beyond basic needs and now must include aesthetic corrections, a new challenge that an implantologist must overcome. Achieving this aesthetic is frequently challenging, if not impossible. Hence this article encompasses an overview of the contemporary clinical parameters of esthetic implant therapy, principles of the

peri-implant architecture including hard and soft tissue esthetics along with some potential treatment complications in the aesthetic zone.

Contemporary Clinical Parameters- Diagnosis & Treatment Planning

In the modern world, achieving optimal implant aesthetics requires more than one step or process. To reduce the aesthetic risks associated with dental implants, a thorough esthetic diagnosis must be made. This involves collecting all the relevant aesthetic data including the patient’s expectations regarding aesthetics into account prior to offering a possible prognosis of an impending implant rehabilitation. Hence performing a thorough esthetic diagnosis has become imperative to ensure predictable results in the placement of restoratively driven implants.

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) The appearance of an implant restoration can depend on several factors, such as individual’s smile line, tooth shape and position, periodontium biotype, size, type of implant and bone anatomy.

Principles of esthetic therapy:

Clinicians’ expanding use of cosmetic restorative procedures has generated greater interest in the determination of esthetic guidelines and

Table – 1: Esthetic clinical parameters - Diagnosis & treatment planning

Photographs (extraoral/ intraoral)	Study casts	Clinical history	Radiographs
Oblique/facial /occlusal view	Maxillary & mandibular diagnostic models	Medical–systemic diseases	IOPA
Rest position	Edentulous model	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	CT Analysis

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standards¹. The esthetic criteria can be broadly analysed through clinical parameters such as macroesthetics, miniesthetics, and microesthetics as proposed by Sarver & Ackerman² (Table -2)

Precision in implant placement often requires the tooth positions to be evaluated in apico-coronal, buccal-lingual, and mesio-distal planes, as 3D implant placement has high significance on the regeneration of gingival architecture.

Hard & Soft Tissue Aesthetics

In an aesthetic zone, rehabilitation in general, is very technically known for its precision. Consequently, a number of strategies have been put forth to stop bone loss and maintain the amount of hard and soft tissue within the intervention area. Success in implant rehabilitation involves the following areas: peri-implant hard tissue augmentative surgery, precision in implant placement, and peri-implant soft tissue management.

Clinical anatomic site analysis for ideal soft and hard tissue esthetics should include³:

1. Lip line esthetics. (ie; location of smile line: high, medium/ low; lip support & length)
2. Gingival morphotype. (ie; thin with high scallop vs. thick with shallow scallop)
3. Interocclusal relationship. (ie; occlusal plane, horizontal and vertical overlap)
4. Status of tooth to be replaced and adjacent dentition. (eg; crown integrity, endodontic and peri-

odontal status)

5. Status of the site and adjacent soft tissues (eg; excessive gingival display/gummy smile or inadequate soft tissue because of gingival attachment loss resulting in gingival recession, gingival asymmetry, or a mucogingival problem)

6. 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.

7. Radiographic status (eg; 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:

The strategy for achieving hard tissue architecture include employing bone graft materials, varying implant loading and placement timing protocols, designing new implants and placing them in particular locations. The proficient hard tissue augmentation procedures generally performed include atraumatic tooth extractions, ridge preservation procedures (bone grafts, guided tissue regeneration) with immediate implant placement, partial extraction therapies such as the socket shield therapy, flapless implant surgery, ridge augmentation using autogenous grafts, distraction osteogenesis, etc⁴. For reconstruction of the extensive bony defects, autologous, allogeneic or xenogeneic bone graft-

Table – 2: Esthetic criteria

Macro esthetic design	Mini aesthetic design	Micro-aesthetic 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 projection	Anterior tooth -incisor display	Shade of tooth & spacing
Ears	Transverse display.	Triangular holes

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ing (guided bone regeneration), and the application of biological agents along with growth factors are conventionally considered⁵.

Soft tissue aesthetics:

The predictability of the peri-implant esthetic outcome may ultimately be determined by the patient’s own presenting anatomy which include relative tooth position, form of the periodontium, biotype of the periodontium, tooth shape, and position of the osseous crest⁶. The most popular peri-implant soft tissue techniques include: minimally invasive techniques that cause less tissue trauma; alveolar socket treatment to maintain natural architecture, platform switching, aesthetically appealing flap designs, innovative methods for closing soft tissues that offer better visualization during second-stage surgery with less scarring, inlay connective tissue grafts, which make up a large portion of contemporary implant therapy, and onlay grafting techniques to expand the keratinized band zone or stop further soft tissue recession. In the anterior region, developing an emergence profile (figure -1) have become more crucial to the success of implant restorations because they aim to closely mimic the natural teeth and produce an equilibrium between the blend of hard and soft tissue contours.



Figure-1 emergence profile

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
- Peri-implant papilla
- Biologic width
- Platform switch concept
- Abutment disconnection and microlesion
- Crestal bone height
- Interproximal distance
- Tooth form and shape
- Gingival biotype
- Tooth position
- Type of gingival scallop
- 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.

Table – 3: Esthetic criteria – Pink & White score

	Score	White esthetic score	Score
Mesial papilla	2	Tooth form	2
Distal papilla	2	Outline / volume	2
Curvature of facial mucosa	2	Colour (hue/value)	2
Level of facial mucosa	2	Surface texture	2
Root convexity / soft tissue color & texture	2	Translucency / characterization	2
Maximum score	10	Maximum score	10

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Esthetic Criteria – Pink & White Score

Esthetic considerations of implant crowns on anterior teeth uses different proportions, including “red” as well as golden proportions. The pink aesthetic score was developed by Furhauser et al⁷. while the white aesthetic score was defined by Belser et al⁸. (table-3) and they aid in assessing the soft tissue esthetics around implant placement.

The Pink esthetic score is based on variables such as mesial papilla, distal papilla, soft-tissue level, soft tissue contour, alveolar process deficiency, soft-tissue color and texture. Each variable is assessed with a 2-1-0 score, with 2 being the best and 0 being the poorest score. The highest possible score reflecting a perfect match of the peri-implant soft tissue with that of the reference tooth.

Provisionalization

The provisional restoration is a critical component of an overall treatment plan as it affords the opportunity to critically evaluate the function and aesthetics in a material which can be easily manipulated. Provisionalisation in implant rehabilitation provides esthetics, maintains masticatory ability, and preserves space as they intend to preserve and ultimately control the peri-implant hard and soft tis-

ues by mastering the restorative material stacked between the implant shoulder and that portion of the restoration which is visible supra gingivally. Fabrication and manipulation of the provisional restoration give both the clinician and patient an opportunity to slowly manipulate the peri-implant tissues for the benefit of contours and ultimately the aesthetic advantage. Once functional surfaces, restorative contours, tissue margins and dento-gingival complex profiles are established to both the patients and clinician’s approval, then they are able to proceed with the definitive restoration⁹.

Treatment complications in the aesthetic zone

Esthetic failures are predominantly caused by inappropriate implant positioning and/or improper implant selection¹⁰. Treatment complications can range from fracture of the prosthetic components to a transient inflammatory condition; however, this article addresses the possible complications in the esthetic zone(table-4), which involves the possibility of failure only due to esthetic reasons.

Many esthetic complications can be prevented if adequate presurgical planning is done, and appropriate corrective measures taken during surgical phase, and subsequently the prosthetic phase.

Table – 4 Treatment complications in the aesthetic zone- Etiology

Iatrogenic causes	Anatomic causes
Selection of 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 tissues	Vertical bone deficiencies at adjacent root surfaces
A surgical approach that overstresses the healing capacity of the tissues, leading to the resorption of the facial bone wall	Implant sites with multiple missing teeth leading to the placement of adjacent implants
Malpositioned implant entering a danger zone in a coronal, mesiodistal or orofacial direction	Aberrant pathology.

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Conclusion

The goal is to create gingiva and related structures that look beautiful and natural. Optimizing techniques unique to the pre-prosthetic, pre-implant, and prosthetic stages is largely responsible for maximising the esthetic outcome. Therefore, given the dynamic stature of the modern implant therapy, the art of incorporating a desirable implant-supported prosthesis towards a beautiful smile requires a thorough aesthetic diagnosis, a holistic approach to implant construction, and careful implementation of the planned treatment from a contemporary perspective. Having reasonably contemplated the aesthetic principles of importance in implant rehabilitation, the present review attempts to cover an overall picture in attaining perfection in aesthetics especially red or soft tissue aesthetics. Futuristic studies regarding the aesthetic outcome can further be enhanced by utilizing cutting-edge digital technologies involving software applications for evaluating clinical and biological indicators of the prosthetic field of view, virtual planning of implant positioning, and design forecasting of future prosthesis.

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