

Understanding implant esthetics: Where function meets looks.

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Abstract

Purpose: The aim of this article is to comprehend the numerous factors that can influence aesthetics of an implant prosthesis.

Study selection: The data has been sourced from various books and articles about implant aesthetics.

Results: It can be seen that modern implant dentistry prioritises aesthetics, which is connected to a natural-looking, harmonious smile, in addition to function, speech, and health. Nowadays, emphasis has shifted to creating a cosmetic rehabilitation that camouflages with the existing tooth structure and has strong, long-lasting surrounding tissues throughout time. The dentist must consider a variety of elements that affect the final appearance prior to implant placement. Aesthetic parameters of the future prosthetic restoration should be planned and assessed. The use of modern digital technologies, virtual planning of implant positioning, and design projection of future prosthetic restoration can improve the aesthetic outcome.

Conclusion: Aesthetic pleasure promotes patient confidence and self-esteem and hence the secret to a satisfied happy patient is a systematic effort involving implant placement, soft tissue care, and the rehabilitation by a prosthesis.

Keywords- Cone Beam Computed Tomography, Diagnostic imaging, Guided tissue regeneration, Implant, Implant esthetics.

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Introduction

The hankering needs to replace missing teeth is as old as the origin of medicine. The agenda of modern implant dentistry not only pivots on the function, speech, health but also aesthetics^[1] which is linked to a natural looking harmonious smile.^[2] Aesthetics is the retaliation of our minds and emotions to the prepossessing which is well ingrained by Lew Wallace words stating “Beauty is altogether in the eye of the beholder”.^[3] Scientific advancements have radically altered the face of current implant therapy. Whereas endurance and longevity were formerly regarded the gold standard, aesthetics is now the objective of the hour.^[4]

With high implant survival rates, the focus has switched to constructing a cosmetic

restoration that is indistinguishable from the neighboring tooth structure and has robust, long-lasting surrounding tissues throughout time.^[5] Hence, the purpose of this article is to understand the various aspects in expedition to providing an implant prosthesis that might possibly affect its aesthetic outcome.

I. First Assess and Plan

It is essential to establish realistic expectation in context of aesthetics and its probable outcome constructed on known biological authenticities and the competence of the clinician which includes:

a. Complete Aesthetic Diagnosis

A theoretical framework like “14 fundamental objective criteria” designed

explicitly for single tooth implant therapy and proposed by Mange et al. in 2003 (modification given by Cooper in 2008) can be employed to perform evaluations providing enough data to define any aesthetic limits and a framework for discussion of all feasible interventions. This can further be utilised to prepare diagnostic wax up of tooth/teeth to create radiographic guide indicating position of the future prosthesis in the cone beam computed tomography (CBCT) imaging.^[6]

b. Site Development and Biological Realisms

The underlying biological certainties and its linked individual situation evaluation includes concerns of:

1. Tooth and Soft tissue display-

Individual's lip length and position, position of maxillary arch for defining tooth display which is more often considered a risk factor and a challenge for achieving aesthetics. Special thoughtfulness must be paid to the health of gingiva, interdental space, gingival contour's zenith, gingival levels equilibrium, and important tooth form characteristics.^[6]

2. Periodontium health and design-

When biological width is violated, soft tissue lies at a jeopardy of tenacious inflammation alone or along with recession.^[7] When any osseous limitations is identified, successful ridge preservation and alveolar regeneration procedures should be advised. Facial tissues thickness over dental implant, implant tooth papilla's form, symmetry and biotype are also determining factors that effects aesthetics outcome as proposed by various studies. Periodontal probe can be used to assess the thickness of the mucosa prior extraction. Thin biotype recedes even with nominal surgery and moves superiorly post-surgical bone loss, leading to an unesthetic state.^[6] Thick biotype does not necessarily

also alone guarantee resistance to marginal tissue recession and therefore, other factors such as operator and patient variables and technicians' skills should also be considered.^[8]

3. Overall general tooth health and existing restorations condition-

Adjacent teeth and restorations' health and state have significant influence on the aesthetic outcome. The possible shortfalls need to be acknowledged for aesthetical satisfaction even if they may not be the main reason for the patient visit.^[6]

4. Existing occlusion and prosthetic consideration-

Simple occlusal issues if not addressed can lead to marked difficulty. Prolonged loss of maxillary anterior tooth is usually accompanied by the antagonist mandibular tooth migrated facially and/or supraerupted. altered teeth position that are not initially identified, can be detected by using study casts that can be mounted or by diagnostic wax up. Jaw relation (e.g., classification given by Angle), the disparity between centric relation and occlusion, and pattern of occlusion are all evaluated (Fig. 1 and 2). The edentulous space measurements and vertical dimension evaluations (e.g., the interocclusal space) for implant sites significant impact treatment planning.^[6] The minimum vertical dimension required for implant-supported prostheses (crowns) is 8 mm, and 12 mm required in case of removable prostheses reinforced over implants.^[5] In the aesthetic zone, overbite and overjet, should be documented. Oral features seen in bruxers or clenchers or other parafunctional habits, as well as the existence of interferences (occlusion) during working or nonworking movements, should also be monitored since they may lead to late implant failure.^[6]

5. Pathologies

Clinical examinations should include visual inspection and palpation to screen for pathologic abnormalities of hard and soft tissues.^[6]

c. Diagnostic Imaging

Cone beam computed tomography (CBCT) scan is the most inapt means in evaluating bone height and width before implant placement. It is also efficient in detecting any concavity and its relation to the adjacent teeth apart from visualizing bone morphology in three dimensions. Periapical radiograph can be used to assess interproximal bone location (Fig. 3).^[6]

d. Clinical Competence

The dentist and the team must possess techniques and materials that positively reinforce the outcome and develop ideal implant restoration.^[6]

II. Understanding Science and Sequence of Implant Therapy

Individual assessment is required to understand patient's expectation as they expect the same level of aesthetics from the tooth prior to extraction when it is positioned in the aesthetic zone even if it had compromised supporting structures or any associated pathology.

Information should be assorted to formulate a treatment plan after reviewing past medical history, physical examination and other data records which can result in an unacceptable implant restoration. Standardized photographs are also employed to pronounce the existing condition to both the patient and contemporaries as well as to compare the results with the rehabilitation plan using digital image (Fig. 4). The pictorial illustrations of incisors seen relaxed in rest position with lips a tad apart, smile line representing incisal show (crucial in patients with short clinical crown, or gingival

recession and are candidates for crown lengthening), retractors are placed to capture front view, both right and left lateral views and photographs in full occlusal and lastly both right and left lateral view photographs of teeth in occlusion that will depict the relation of ridges and the posture of the lips are made.^[6]

Appreciating the bone morphology and tissue biotype is essential (Fig. 5). Treatments that can include procedure of converting thin into thick biotype is required as thick gingiva shows less recession when bone loss is seen and can be managed with provisionalization.^[6,9] Labial bone evaluation is done by measuring the depth to which the probe penetrates the gingival sulcus as well as the loss of soft tissue in the form of recession, erythema present over the gingiva and lastly decrease bone dimensions as seen on the CBCT scan. Whenever labial bone loss is seen in combination with the presence of thin gingival biotype, an allograft in the socket along with graft of connective tissue can be placed under labial mucosa during the same session.^[7] To achieve success for long, medialized abutment-implant interface and abutment that is concave should be submerged to form thick tissue. Addition of xenograft which is sintered can also promote the augmentation of contour of the gingiva when used during implant placement.^[10]

Using sulcular incisions with no vertical releasing incisions for treatment of anterior maxilla tooth/teeth to effectively prevent recession of the gingiva.^[6]

Emergence of the use of implant with moderately rough surfaces has radically reduced the difficulties associated with the use of conventional machined-surfaced implants specially while deal with Lekholm and Zarb type IV bone and has made use of shorter implant possible.^[11]

Either one of the known three different types of major retentive features at macroscopic

level exists which includes tapped or self-tapping type of screw threads, press fit designs with solid body and technologies that uses sintered beads. These features are intended to enhance implant stability (initial) and helps in bone ingrowth by providing large spaces. During implant placement, its primary stability is assessed in terms of its length and diameter, shape, roughened surface, design of the thread of different renowned threaded implant designs. Various methods to accelerate bone adaptation has been introduced which embraces attempt to enhance the bone ingrowth by surface topography, methods to use implant for bioactive coating transported locally and biological progressions to enhance growth of different surface cells. It is believed that surface roughness enhances bone adaptation providing greater surface area further allowing greater area for transfer of bone load in apposition to implant surface.^[6] Mechanical features at microscopic level also influence the secondary integration by making using of acid to etch the surface.^[12] The two approaches that are related to each other and currently being evaluated for bone adaption around dental implant surface includes addition of living intermediaries to the implant surface (e.g., adhesion of cell or peptides that are biologically active, growth factors, etc.) or by incorporating surface features that can be reproduce again and again at nanoscale level, or by using biological responses to again integrate nanoscale surface features topographically on implant surface made up of titanium oxide.^[6]

III. Determining Superlative Position of Implant in the Smile Zone

This can be achieved by using manual or digitally created diagnostic wax up made from accurate impressions or digital scans (Fig. 6).^[6] The aesthetics as well as how these diagnostic wax-up integrate into the patient surrounding and the oral cavity can be well

projected by the process known as the “Aesthetic Mock-up” after obtaining the ideal, outline, position & proportions of the implant prosthesis.^[15]

Prior to surgical implant placement, the potential site and neighbouring anatomical structures must be thoroughly assessed along with evaluating buccal plate thickness, the gingival tissue phenotype to efficiently mask the interface between the implant and abutment at the crestal level of the alveolar bone rest which must lie 3 mm and 2 mm apically and palatal respectively to the gingival zenith.^[7]

The overall soft tissue aesthetics is directly influenced by the emergence profile of the implant prosthesis which in turn is affected by the position of the implant. Therefore, its position should be planned in advance by the surgeon as well as the clinician fabricating the prosthesis.^[7,16]

Screw-retained restorations requires angulated implants such that the access and retrieval should be through the palatal side of the prosthesis.^[6] Screw channels that are angulated have made the change of angulation of the access hole achievable, making screw retained restorations a breeze. Although customised abutments can adjust for implant angulation, if shows are major increase, the abutment wall thickness becomes too thin and can serve as a weak link in the implant prosthesis. To avoid abutment fracture in such circumstances, titanium or gold abutments must be used instead of ceramic abutments.^[6]

Because biological and prosthetically available alternatives can influence the aesthetic result, implant dimensions, cervical anatomy, and restorative options should be discussed and preplanned in advance by surgeon and restorative dentist (Fig. 7).

An implant diameter that reduces the requirement for grafting while providing enough abutment thickness for strength should be chosen. Extremely long implants

are not required since load delivered occlusally will only be transmitted to the implant cervical section. The clinician must also choose an implant that is compatible with the optimal components and includes cosmetic characteristics (for fit, material, and shade) that guarantee the implant restoration replicating natural dentition.^[6]

IV. Utilising Trends & Advances When Necessary for Tissue Augmentation

Dental implants can be volumized with the calvarium, tibia, and iliac crest can serve as sources of autogenous bone along with including recently popularized mandibular symphysis and ramus for bone block grafting (Fig. 8). The maxillary tuberosity, angle of the jaw, ramus, and exostoses are some more intraoral donor locations.^[13]

Guided Tissue Regeneration (GTR) was originally used in clinical practise by Nyman and colleagues in an experiment based on Melcher's hypothesis. Cellulose filters and Expanded polytetrafluoroethylene membranes (ePTFE) are examples of non-resorbable membranes that can be used. They enable liquid and nutritional items to flow across the wall, but their microscopic porosity prevents movement of cell. Membranes of collagen, polylactic and polyglycolic acid, synthetic liquid polymer polyglactin, calcium sulphate, allografts made up of cutaneous acellular tissue and cellulose mesh that are oxidised are examples of materials that resorbs with time. They benefit in avoiding a second surgical treatment, lowering patient morbidity and cost.^[6]

The soft tissue grafting is done based on its indication and the likings of the surgeon (Fig.9). Assessment of risk is suggested during planning of the treatment to include keratinized mucosa (KM) augmentation if it is judged necessary. Various techniques have been presented to increase the thickness of KM include the deepening of vestibules or

use of flap that are positioned apically, free gingival graft (FGG), subepithelial connective tissue graft (SCTG), acellular dermal matrix (ADM), and xenogenic bilayer collagen matrix (XCM).^[14]

V. Evaluating Peri Implant Aesthetics Parameters

The white aesthetic score (WES), given by Furhauser et al. in 2005, and the pink aesthetic score (PES), given by Belser et al. in 2009, assess and classify the aesthetic success of the treatment.

VI. Implant Provisionalization

In restoration that are both tooth and implant-supported that have pontics, the placement of a provisional prosthesis can help mold the contour supragingivally to that of the surrounding soft tissues. Its outcome will help to preplan the final prosthesis contour.

Granting there exists many ways to provide provisional restoration in the area of implant, including the Essix appliance, a provisional (acrylic) PRDP, or a provisional FDP of the "Maryland" type, none of these alternatives provide the same level of control over profile of the soft tissue and, consequently, the ultimate peri-implant tissue aesthetics compared to the one where a provisional restoration is placed over the implant (Fig.10-11).

Although, Plastic (PEEK) and Titanium can be used as a material for provisional abutment, PEEK is less tolerant occlusal function resistance applied over a long period of time side to side/bringing the mandible forward movement forces in patients with a deep overbite. Solid titanium is difficult to modify with rotary instruments thus profile that is not seen or submerged must be contoured to achieve in desired change in the gingival margin position. Therefore, metal cylinder or chimney is the provisional

abutment that can serve as the basis for the best provisional restoration.^[6]

VII. Selecting Biomaterial for Abutment and Restoration

Selection criteria for the materials with which the abutment and the superstructure are crucial in the aesthetic zone since they are the primary determinants of stability and durability in this area.^[6,17] Biologically compatible material fulfilling the aesthetic required in order to achieve a prosthesis that is naturally appealing.

Consequently, primary metal types materials like titanium and titanium alloys can be used for their mechanical strength, biocompatibility and biostability. Alumina and zirconia ceramics are also utilised for aesthetic purposes and can be coupled with a metal surface to form metal ceramics or used alone as all ceramic (Fig. 12).

A prefabricated or stock abutment does not provide the required naturally aesthetic appearance. Thus, a custom abutment that live unto anatomical standards can be used to achieve the desired aesthetic appearance. Superstructures can be either screwed or cemented to the abutments.

The abutment and crown complex's wherever feasible should be concave and should lie 0.5mm and 1.0 mm subgingival to the implant body, as reported by Rompen et al.^[10]

The type of abutment used when creating custom abutments for implants in the anterior aesthetic zone affects the colour of the gingival tissue therefore, zirconia abutments can be used as they come in a wide range of colorations.^[6]

VIII. Management of Peri-implant Diseases

Despite improvised clinical trials that focus primarily on improving biology and biomechanics of implantology, the anticipated clinical success still shows increasing incidence of diseases of both soft and hard tissue surrounding the implant. Specific maintenance programmes should be developed for the patient to reduce the risk of

developing peri-implant disease when the clinician is conscious of parameters of implants and teeth. Patients must understand the value of maintenance procedures, and clinicians must evaluate patient compliance to home care regimens.^[5]

Conclusion

On a whole, dental implantology is rapidly moving ahead through technological advancements.^[18] Implant dentistry is now not only restrained basic needs but also the evolved esthetic corrections that now uplifts the confidence and the self-esteem of the patient.^[19] through the art of rehabilitating the patient with esthetical prosthesis. Hence the key to a satisfied and happy patient is a collaborative approach to implant placement, soft tissue management and the rehabilitation by a prosthesis.^[18]

References

1. Duraccio D, Mussano F, Faga MG. Biomaterials for dental implants: current and future trends. *J Mater Sci.* 2015;50:4779-812.
2. Tjan AHL, Miller GD. Some esthetic factors in a smile. *J Prosthet Dent.* 1984 Jan;51(1):24-8.
3. Fuentealba R, Jofre J. Esthetic failure in implant dentistry. *Dent Clin N Am.* 2015;59:227-46.
4. Salam EAAE. *Advances in esthetic implant dentistry.* Hoboken(NJ): Wiley Blackwell;2019. p- 1-392.
5. Resnik RR, Misch CE. *Misch's contemporary implant dentistry.* 4th ed. Missouri (US): Elsevier; 2021. p- 1-1241.
6. Karateew ED. *Implant aesthetics keys to diagnosis and treatment.* Illinois (US): Springer International Publishing. p-1-450.
7. Kan JY, Rungcharassaeng K, Sclar A, Lozada JL. Effects of the facial osseous defect morphology on gingival dynamics after immediate tooth replacement and guided bone regeneration: 1-year results. *J*

- Oral Maxillofac Surg. 2007;65(7 Suppl 1):13–9.
- 8.Evans CD, Chen ST. Esthetic outcomes of immediate implant placements. Clin Oral Implants Res. 2008;19(1):73–80.
- 9.Langer B, Calagna L. Subepithelial connective tissue graft to correct ridge concavities. J Prosthet Dent. 1980;44:363–7.
- 10.Block MS, Kaleem A. Use of Sintered xenograft over allograft for ridge augmentation: technique note. J Oral Maxillofac Surg. 2014;72(3):496–502.
- 11.Widmark G, Andersson B, Carlsson GE, Lindvall AM, Ivanoff CJ. Rehabilitation of patients with severely resorbed maxillae by means of implants with or without bone grafts: a 3-to 5-year follow-up clinical report. Int J Oral Maxillofac Implants. 2001;16(1):73–9.
- 12.Stanford CM, Brand RA. Toward an understanding of implant occlusion and strain adaptive bone modeling and remodeling. J Prosthet Dent. 1999;81(5):553–61.
- 13.Pabari M, Srinath N, Veeresh M. The art of block grafting in the preparation of site for an implant. J Dent Allied Sci 2012;1(1):37-40.
14. Abou Arraj RV, Pizzini A, Nasseh P, Basma HF. Soft tissue grafting around implants: why, when, and how? Curr Oral Health Rep. 2002;1-16.
- 15.Magne P, Belser U. Bonded porcelain restorations in the anterior dentition: a biomimetic approach. Quintessence Publishing Co, Carol Stream(IL):2003. p 200–25.
- 16.Phillips K, Kois JC. Aesthetic peri-implant site development. The restorative connection. Dent Clin N Am. 1998;42:57–70.
- 17.Martin WC, Pollini A, Morton D. The influence of restorative procedures on esthetic outcomes in implant dentistry: a systematic review. Int J Oral Maxillofac Implants. 2014;29(suppl):142–54.
- 18.Mangal K, Dhamande MM, S Sathe, Godbole S, Patel RM. An overview of the implant therapy: the esthetic approach. Int J Cur Res Rev. 2021 Jan;13(2):106-12.
- 19.Somanathan RV, Simunek A. Aesthetics in implantology. Acta Medica. 2006;49(1):19-22.

FIGURES

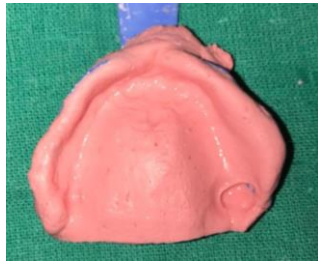


Fig. 1



Fig. 2

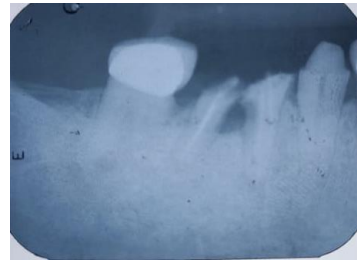


Fig. 3



Fig. 4:

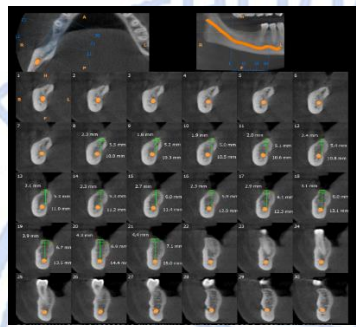


Fig. 5

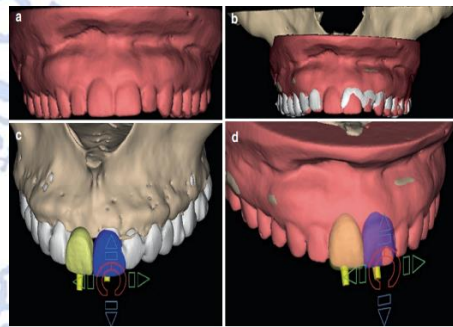


Fig. 6

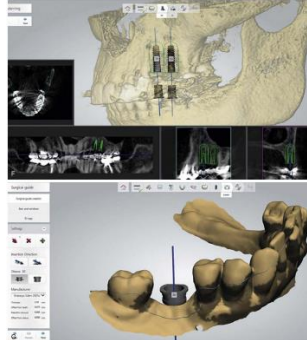


Fig. 7



Fig. 8



Fig. 9



Fig.10



Fig. 11



Fig. 12