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CHARACTERIZATION – THE ART AND SCIENCE OF PROSTHODONTICS

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ABSTRACT

Prosthodontics is a unique speciality combining art, philosophy and science. This makes aesthetics an important guiding factor in any treatment plan involving Prosthodontic rehabilitation. Aesthetics is a subjective entity and patient's expectation should hold great importance in fabrication of the prosthesis. Dentist should be capable enough to identify the patient's demand and incorporate that in further treatment.

A great volume of methods and materials have been introduced and the existing ones have evolved over time to better achieve aesthetic requirements. The dentist should give due consideration to appearance of removable prosthesis, fixed dental and implant supported prosthesis as well as the maxillofacial prosthesis in order to achieve greater patient satisfaction.

Keywords: Characterization, Aesthetics, Customization, Detailing, Appearance

INTRODUCTION:

In recent decades, esthetics has become one of the major factor driving the treatment planning in dentistry. With increased awareness and enormous influence of digital media in the society, patients are demanding superior aesthetics along with the functional rehabilitation. It is of prime importance for dentist to consider the aesthetic objectives of any treatment planning at all times in order to achieve better patient satisfaction **[1]**.

Among patients a great difference is seen in attitudes of patients towards their appearance of teeth. Women are more often dissatisfied with their dental appearance as compared to men. Teeth color has been reported as most common reason (56.2%) for inability to meet patient's expectations **[2]**. Mal-alligned upper teeth with protrusion or crowding have also been frequently identified by patients as unaesthetic. Studies have shown that a dentist is keener to identify minute deviations from ideal conditions when compared to a normal person **[3]**.

With such wide spectrum of variation in perceptions of favorable appearance, the dentist needs to deliver a treatment plan that acknowledges the aesthetic expectations of a patient. Therefore, a dentist should be aware about the different characterizations and detailing possible in removable prosthodontics, fixed dental prosthesis, implant supported prosthesis and maxillofacial prosthesis and the recent advancement in all fields that have been reported in literature **[4]**.

CHARACTERIZATION

Characterization in Prosthodontics means the application of unique markings, indentations, coloration, and similar custom means of delineation on a tooth or dental prosthesis, thus enhancing natural appearance **[5]**. This process enables the dentist to fabricate a more life like prosthesis which may stimulate similar dental appearances with which patient entered the dental office **[6]**.

COMPLETE DENTURE

Diseased teeth are quite often saved and unattended because patients don't desire artificial look of the dentures. This demands personalized denture fabrication which is according to the patients demands. In 1953, Protactor had popularised Colorblend (by L. D. Caulk Company), a shade guide to tint the denture base polymers to achieve more natural looking dentures. Since then a lot of advancements and methods have been tried to characterize complete dentures **[6]**.

Frush and Fischer came up with idea of dentogenic concept of denture construction which includes the age, sex, personality of dentate population as guidelines for life like characterization of removable complete dentures **[21]**.

Denture characterization methods: **[7]** **(Figure 1)**

1. Characterization by selection, arrangement, and modification of artificial denture
2. Characterization by tinting the dentures base.

Figure 1: Various techniques of complete denture characterization

- Labial Lipping: Long standing edentulous patients are often unhappy with inadequate lip support. They may require excessive labial fullness to avoid lower facial wrinkles.
- Crowding/Spacing: Crowding or spacing of anterior denture teeth along with asymmetry gives a more natural appearance to the prosthesis. A patient with previously crooked teeth may get a psychological empowerment if the previous dental appearance is achieved in the replacement denture.
- Stained gingiva: Coloring the denture bases with hues resembling the gingiva may camouflage better in the oral environment. This will make it difficult for normal person to detect an artificial prosthesis.
- Multiple sets of teeth: This can help us achieve optimum occlusion along with satisfactory aesthetics in abnormal ridge relation **(Figure 2)**.
- Gingival recession: More exposure of denture teeth and irregular gingival zenith may give a natural appearance to the denture base. Stippling and festooning can also be incorporated to improve details.
- Denture coding: Bar codes, QR codes and unique identification numbers can be incorporated in the denture base to easily access the patient records.

- Attrided mandibular incisors with stained incisal edge: Tobacco chewers often have stained teeth along with attrition, recreating such details may be well accepted by patients as life like dentures.
- Fractured tooth: Generally, minor fracture of anterior teeth are present for years without bothering the patient. The patient gets used to such asymmetrical and unusual appearance which can be achieved if previous records are there with dentist **[7, 8]**.

Figure 2: Two sets of teeth

FIXED DENTAL PROSTHESIS

Cementing a fixed dental prosthesis with correct occlusal relation and proper fit over the prepared tooth can still be disheartening for a dentist if the color of prosthesis doesn't coincide with environment **[9]**. A single tooth fixed prosthesis can be one of the most challenging cases to achieve characteristic shade with minimum margin of error **[10]**.

To achieve natural appearance of porcelain restoration, dentist should be well versed with the science of color, anatomy of teeth and optical properties of porcelain. Staining, surface textures, fracture lines, crazing are some of the details that can characterize the prosthesis. Staining is broadly divided into intrinsic staining and extrinsic staining. Intrinsic staining includes ceramic modifiers that can be added in between the ceramic firing process itself, which gives dentin like opaceous effect, but at the same time is very difficult to predict the resultant appearance after firing. Extrinsic staining, on the other hand enables the technician to incorporate

different contours and effects after the whole crown is formed. It also allows the dentist to follow chair side staining to improve the aesthetics of the crown if he/she is not satisfied by the prosthesis **[9, 10]**.

Better communication between dentist and technician will more often result in a prosthesis with satisfactory aesthetics. As far as possible, the dentist should have proper lighting conditions recommended. Technicians should have similar lighting conditions as dental operatory while assessing the prosthesis. This will help to achieve exact shade as demanded by dentist by eliminating the metamerism effects.

While determining the shade of the prosthesis, gingival shade plays a vital role. Dentist needs to keep in mind the color reflection from the abutment and color reflection from gingiva. The hue, texture and shape of the gingiva, margin positions are important factors to determine the shade of cervical porcelain.

Fixed dental prosthesis in aesthetic zone may require pink color gingiva porcelain veneers in cases of previously periodontally compromised cases or mask severely resorbed ridges. *"Pink esthetics"* helps to reproduce the gingival architecture and recreate visual harmony between the teeth and the surrounding gingiva **[11]**.

IMPLANT SUPPORTED PROSTHESIS

Implantology cannot be separated from high treatment cost and long treatment duration at any time. This automatically enforces the implantologist to plan a treatment that not only addresses the functional limitations but also caters the aesthetic expectations. Rehabilitation of oral tissues with implants require various consideration to reproduce lost architecture. Optimal implant position, stable and healthy peri implant soft tissues, aesthetic soft tissue contours and ideal emergence profile are important factor to achieve appealing red and white aesthetics **(Figure 3) [12]**.

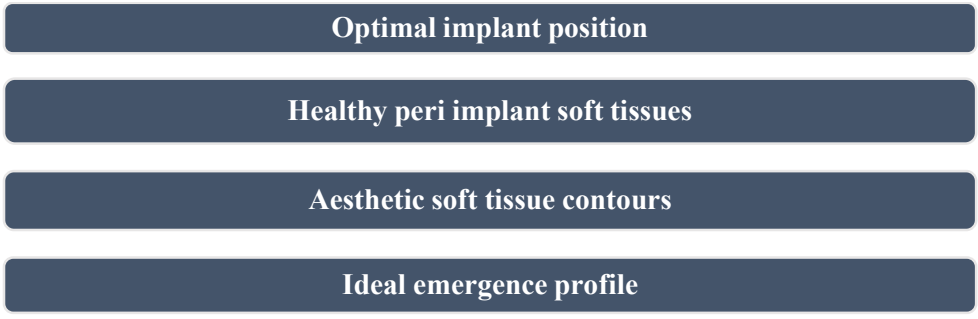


Figure 3: Factors determining aesthetics in implantology

Emergence profile is an important factor determining the relation of gingiva and implant prosthesis. Adequate thickness allows for optimum soft tissue remodeling around the prosthesis which is even more crucial in anterior region with patients having high smile line. It also helps in long term stability of the implant **[13]**. Zirconia implants are preferred choice for aesthetic cases with thin gingival biotype because such soft tissue cannot mask the titanium implant color. Also it is easier to do shade matching of crowns over zirconia implant with natural tooth. Marginal bone loss was reported to be less compared to titanium implants by some studies **[14]**. Fabrication of customized Zirconia abutment by Computer-aided design/computer-aided manufacturing has shown to be the most reliable tooth colored material for aesthetically driven cases **[15]**.

MAXILLOFACIAL REHABILITATION PROSTHESIS

One of the greatest challenges to the Prosthodontist is to replicate the skin color of the patient in the maxillofacial prosthesis. An individual's skin color is influenced by the genetic, geographical and cultural factors. South Asian subcontinent is mostly comprised of wide range of skin complexion ranging from light to dark. Even after advancement in material science and technologies, trial and error method is still the most common method to match the shade of prosthesis to skin color of patient **(Figure 4)**.

Anitha *et al*., **[16]** have formulated a 15 color shade guide to match the silicone prosthesis for the Indian population. With only handful of practitioners using colorimeter and spectrophotometer to assess the color shade, this guide comes out to be useful. Also the above mentioned instruments cannot measure the translucency of the material, thus fail to assess the color characteristics in natural light, due to phenomenon called 'Edge Loss'. This justifies the need for such shade guide. Patient's own cell can be utilized to fabricate an error-free prosthesis with the recent developments in 3D printing technologies. They use biodegradable polymer as the scaffold on which the patient's cell can be proliferated. This is will help us achieve highest level of characterization of prosthesis which is difficult to achieve through conventional methods **[17]**.

Figure 4: Shade matching of the ocular prosthesis

With the introduction of percutaneous craniofacial implants, the results of maxillofacial prosthesis post maxillectomy have improved considerably. Superior aesthetics, function and psychological empowerment have led to better quality of life for patients. Implant retained ocular and auricular prosthesis have proven to be more beneficial to patients as compared to traditional prosthetic approaches **[18]**.

REMOVABLE PARTIAL DENTURE

The patients of higher level of education have probably the higher criteria for the aesthetic appearance, as they assessed their RPD aesthetics with lower grades than the patients of lower level of education **[19]**. A great variation in position, size and number of edentulous areas exist in patients making it challenging for the prosthodontist to achieve high aesthetical standards. Following considerations in partial dentures aid in aesthetic treatment outcomes:

Framework design: RPD framework needs to provide sufficient retention and support to prosthesis as well as surrounding tissues. In this quest, dentist shouldn't overlook esthetics and should design framework parts that are not visible from labial aspect.

Shade selection: Choosing a correct shade of denture teeth is crucial in achieving a life-like appearance of the partial prosthesis. Along with teeth shade, denture base tint also should be in conformity with adjacent tissues so that the prosthesis blends well.

Mold selection: Selecting appropriate mold according to adjacent existing teeth can greatly enhance the aesthetic value of prosthesis. If the mold is different from adjacent teeth, it will be easily distinguished by normal person.

Base finish: In order to replicate the patient's lost tissue, the base should be designed in harmony with adjacent soft tissue **(Figure 5)**. Anteriorly, they should merge well with remaining vestibular tissue to bring back the lost facial profile. It is difficult to achieve stains and individual characteristics on acrylic teeth, and even if successful, the color stability and optimal mechanical strength are doubtful. A custom ceramic pontic over the RPD framework can be a better treatment plan **[20]**.

Figure 5: Characterizing removable partial denture

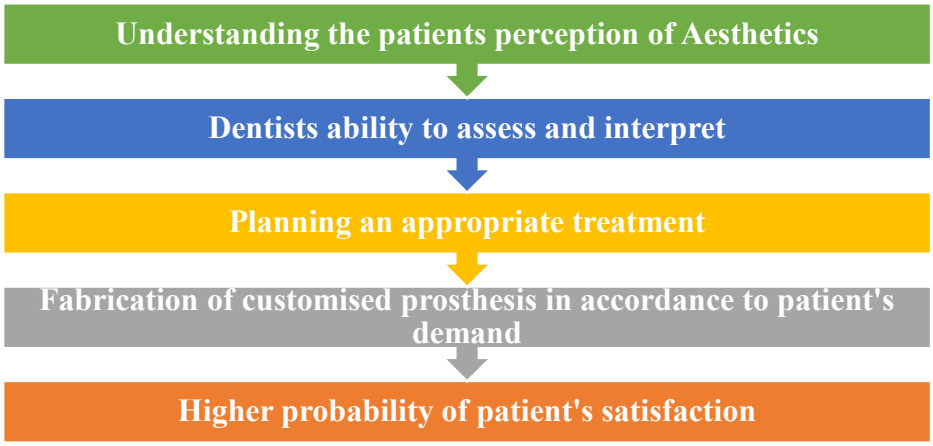
DISCUSSION

The existing literature gives dentists and patients three concepts for the characterization of complete dentures: a dentogenic concept of aesthetics based on age sex and personality, patient oriented selection of dental appearance that may be offset from desirable normal appearance and third is "denture look" which long term edentulous patients may prefer to have. It comes down to dentist and patient's preferences to opt for any concept for denture fabrication **[22]**.

Recent advances in material sciences and better technologies to assess the color of a patient, it makes dentist more efficient in providing a fixed dental prosthesis with various minute details and characteristic that truly rehabilitates the lost tooth/teeth functionally as well aesthetically.

With the introduction of ceramic implants and more clinical evidences supporting the importance of maintaining the right

emergence profile, the incidence of implant failure in terms of aesthetics has been on a decline. Maxillofacial rehabilitations have improved multifold with the introduction of 3D technologies which help us achieve prosthesis as close to natural tissues. Newer techniques like percutaneous implants have made complex cases easier to rehabilitate by providing superior retention.



CONCLUSION

With growing awareness among the patients, improved standards of living, it becomes essential for a dentist to offer a treatment plan which not only meets the functional and biological needs of the individual but also fulfills their aesthetic demands. In order to achieve optimum aesthetic it becomes dentist's duty to be able to accurately assess the patients understanding of their dental appearance and deliver every patient with a customized prosthetic option ranging from removable dentures to fixed prosthesis.

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