Journal of Research in Medical and Dental Science
2022, Volume 10, Issue 10, Page No: 255-259

Available Online at: www.jrmds.in
eISSN No.2347-2367: pISSN No.2347-2545

Techniques of Shade Selection in Maxillofacial Prosthodontics

Sharyu K Khatod[1*], Sharayu V Nimonkar, Seema Sathe, Sweta Kale Pisulkar

Department of Prosthodontics, Sharad Pawar Dental College and Hospital, Datta Meghe Institute of Medical Sawangi (Meghe) Wardha, Maharashtra, India

ABSTRACT

In patients using maxillofacial prostheses, colour matching to the surrounding skin is critical. It is critical to understand the various colour matching and colouring procedures used in maxillofacial prosthetics. The flaws visible in the maxillofacial region are produced by a variety of factors such as trauma, surgical intervention for malignant lesions, or congenital problems, but they have an impact on an individual's psychological and social health. In such cases, an aesthetic maxillofacial prosthesis not only repairs the anatomical abnormality, but also restores the appearance of the face. The patient's psychological well-being. There are numerous things that must be present in order for the project to be successful. Among the maxillofacial prosthesis, "aesthetics" is the most important. Aesthetics of a maxillofacial prosthesis and aspects like retention and close adaption depends on the right shade match. Another significant goal of prosthodontics dentistry is to restore lost tissues and replace missing features while also making the repair or prosthesis look natural and blend in with the anatomical framework structures. The aesthetic value of a product that is perfectly suited to the patient's skin tone boosts the aesthetic value and makes it more appealing. The patient's acceptance of the prostheses in the shade guidelines section, you'll find a variety of visual shade recommendations. There is, however, no literature study that details the qualities, advantages and disadvantages of all of these maxillofacial prosthetic materials. The maxillofacial prosthesis material becomes biomimetic when the shades are properly matched. As a result, the following literature review aims to cover all hypotheses and investigations on shade matching in the field of maxillofacial prostheses. It also covers the many approaches used and a wide range of shade guidelines created to make tone matching simple and more accurate.

Key words: Tone, Shade matching, Facial prosthesis, Spectrophotometer

HOW TO CITE THIS ARTICLE: Sharyu K Khatod, Sharayu V Nimonkar, Seema Sathe, Sweta Kale Pisulkar, Techniques of shade selection in maxillofacial prosthodontics, J Res Med Dent Sci, 2022, 10 (10): 255-259.

Corresponding author: Dr. Sharyu K Khatod
E-mail: sharyu.khatod0512@gmail.com
Received: 03-Aug-2022, Manuscript No. JRMDS-22-47359;
Editor assigned: 05-Aug-2022, PreQC No. JRMDS-22-47359 (PQ);
Reviewed: 19-Aug-2022, QC No. JRMDS-22-47359;
Revised: 03-Oct-2022, Manuscript No. JRMDS-22-47359 (R);
Published: 10-Oct-2022

INTRODUCTION

John Ray has rightly remarked beauty as “beauty is power, a smile is its sword” and we as dental practioners always make it a point to bring a smile on people’s face. “Maxillofacial prosthetics is a branch of prosthodontics which involves rehabilitation of patients with defects or disabilities that were present when born or developed due to disease or defect”. Trauma, tumour surgery, and congenital anomalies can all cause facial deformities. In order to restore function and appearance, such a defect needs be surgically repaired. Surgical reconstruction, however, may not be viable due to the defect's size or placement. Reconstructive surgery may sometimes be ruled out due to patient's medical condition and personal preferences. Prosthetic rehabilitation endures such situations [1]. The biggest challenge a maxillofacial prosthodontics can face is colour matching. The true representation of colour matching of the human physique plays a relevant role in making of a maxillofacial prosthesis and above all in maintaining the aesthetics which is the prime concern of people in today’s world. And any changes in the facial appearance of people hampers their physical, psychological, social and psychosomatic health as well as such patients loses their confidence to stand in front of the world [2]. A prosthesis which is designed for the correction of maxillofacial defects helps the patients to overcome all their problems and regain their confidence to stand back in the outside world [3].

The resources used for the making of maxillofacial prosthesis are acrylic resin, silicone, the addition of colorants gives colour to them [4]. Acrylic resins are durable but they are hard whereas on the other hand silicones are flexible and soft. Silicones also called by the name “polydimethyl siloxane” which has a great share of success in materials used for prostheses made for maxillofacial defects. Silicones gained popularity compared to other materials used for maxillofacial

prostheses because they have advantages like greater tear and tensile strength over a large temperature range, their manipulation is easier, possess high degree of chemical inertness, is least toxic, is stable over large range of temperatures and also has oxidative stability [3]. Colorants are dyes which provide colour to such colourless objects or change how they appear to be coloured. Extrinsic colour matching to skin shade was the only way of colouring maxillofacial prosthesis in ancient times. Barnhart, et al. was successful in fabricating silicone which was commercially available which gave a greater natural appearance, good depth orientation, and a long duration skin tone by tinting the silicone rubber intrinsically [5]. The five pigments namely melanin, melanoid, oxidized haemoglobin, reduced haemoglobin and carotene were used by edward and duntly to attribute skin colour of natural human skin. It was also stated that the characteristics regarding absorption of these five pigments, especially that of the melanin, has a great contribution to the total amount of light which is reflected and it determines hue, value and chroma of the human complexion. The most recent devices, such as spectrophotometers and colorimeters, are said to have enhanced colour matching efficiency. A maxillofacial prosthodontist's work of prosthetic rehabilitation of aesthetic extra oral prosthesis gets increasingly difficult. The success of extra oral maxillofacial prosthesis is dependent on matching shade of maxillofacial silicone. Poor colour matching cause's psychological pain and social rejection, resulting in major negative repercussions on one's quality of life. Due to its superior biological, mechanical, and optical qualities, medical grade silicone has surpassed traditional acrylic resins as the material of choice for facial prostheses. After curing, colour of maxillofacial silicone that was matched during packing frequently surprises the operator. Such circumstances create an uncomfortable situation for both the dentist and the patient. There are a variety of subjective and objective strategies that can be used to address this problem. Various types of equipment, like colorimeters, spectrophotometers, used for colour matching of prosthesis, which is expensive and not commonly accessible, to eliminate subjective inaccuracies.

There are various ways and numerous techniques used to achieve a perfect shade of maxillofacial prosthesis. The trial and error technique of shade matching is widely used in spite of the numerous advanced techniques [6].

Following are the various techniques used for shade selection of maxillofacial prosthesis:

- Spraying technique
- Colour blending with external colour tinting
- Tattooing technique
- Milling machine which incorporated intrinsic colours in silicone
- Different colored rayon-flock fibres
- Colour matching in negros
- Commercially available cosmetic products for shade matching
- Colour verification of facial prosthesis
- CIE lab colour measurements
- Determining colour of vital craniofacial structures
- Shade guide for silicone maxillofacial prosthesis
- Accuracy of contact and noncontact measuring system
- With mobile colorimeter application

LITERATURE REVIEW

Spraying technique

In 1969 Ouellette, et al. developed a spraying technique for toning facial prosthesis. In this technique external spraying was done after casting the basic shade. A feasible method for realistically pigmenting silicone prostheses was the outcome of the technique [7].

Colour blending with external colour tinting

Firtell, et al. developed a technique named basic colour blending with external colour tinting in the year 1969. Its purpose was to describe a method for tinting external facial prosthesis.

This technique includes:

- Preparation of stock colour
- Blending of base shade
- Surface tinting
- Record keeping

Its outcome was replicating external maxillofacial prostheses [8].

Tattooing technique

Schaaf, et al. in 1970 developed a tattooing method for colour-characterizing silicone rubber facial prosthesis [9].

It included three steps:

- Painting a colouring material on prosthesis surface.
- Injecting the paint with a needle up to a depth of 1–2 mm.
- Placing some of the pigments below the surface.

Milling machine which incorporated intrinsic colours in silicone

This technique was given by Chalian, et al. in 1974. Its purpose was to develop a milling machine primarily to give skin tone and texture in the final prosthesis and plays a role in aesthetics.

In this technique-Milling machine is switched on. Intrinsic colours are incorporated in silicone material.

By adding small chunks of silicone material (just a dab of the colour or colours that are needed to match the patient's skin) [10].

Different coloured rayon flock fibres

This technique was given by Fine, et al. in 1978. Technique involved the usage of different colours, named

as "different coloured rayon flock fibres" with eradication of silicone fluid used initially as a thinner. As reported by him shade selection is obtained on a "trial and error" basis or by utilization of instruments and computed methods. The outcome of this technique led to eradication of silicone fluid previously used as thinner [11].

Colour matching in negros

This study was given by Aina, et al. in 1978.

This study was done as follows:

- Three negro patients were selected to represent three basic tones in a wide range of skin tone found in negroes.
- Left zygomatic prominence was initially chosen for shade matching. Final matching was made in bright day light.

With the help of this study it was possible to develop skin tones for negro patients [12].

Commercially available cosmetic products for shade matching

Hanson, et al. gave this technique in 1983. Its aim was to study the role of commercial cosmetic in colouring maxillofacial prostheses. Two cosmetic manufacturers were consulted: mary kay cosmetics, elizabeth arden. Former manufacturer supplied liquid samples of its cosmetics, which were incorporated directly into clear, uncured dow corning MDX4-4210 silicone polymers. In facial prosthesis colouring processes, use of premixed cosmetic earth pigments gives means of transportation that is both efficient and predictable in making skin coloured prosthetics [13].

Colour verification of facial prosthesis

This technique was given by Ma, et al. in 1988. It was used for colour verification of facial prosthesis before the eventual processing. He made a rectangular wedge shaped medical grade silicone specimen to match the hue of maxillofacial prosthesis' skin prostheses [14].

CIE lab colour measurements

This technique was given by over, et al. in 1998. To determine using CIE $L^*a^*b^*$ colour measurements of white facial skin could be related to those of silicone shade samples that visually complemented the dermis. The outcome of this technique the silicone samples and the patient's colorimeter results had a strong correlation, with b^*. The colour dimension is most repeatable and then followed by L^* and a^* [15].

Determining colour of vital craniofacial structures

This technique was given by Gozalo-Diaz, et al. in 2007. Purpose of this study is to determine colour of vital craniofacial structure and evaluate validity and test–retest reliability of a no contacting 45°/0° optical configuration.

This technique included:

- Spectroradio meter with external light source were configured in a no contacting 45°/0° optical configuration.
- To measure tone of patients' vital craniofacial structures (central, lateral incisor, canine, attached gingiva, lips, facial skin).

Major outcome of this technique was the adoption of no contacting 45°/0° optical setup was indicated to be a feasible option due to its acceptable validity and dependability as an alternative to L^*a^*b values received from CIE for craniofacial shade replication and rehabilitation of prosthetics.

Shade guide for maxillofacial prosthesis

Shade guide for Indian skin

This technique was given by Guttal, et al. in 2008. The aim of it was to develop a shade manual for Indian skin tone.

In involves:

- 1, 2, 4 and 6 mm like this four step wedge of silicone were made and powder pigments were added.
- It was tested in malar region.
- It was measured by digital analyser.

This technique gave us a silicone shade guide of three basic skin tones like light, meduim and dark complexion [16].

Shade guide for human skin

This was given by Wee, et al. in 2013. The goal of this method was to design a skin shade manual for human skin of different racial groups.

- One hundred and nineteen people were screened.
- When asked to remove makeup from his face, he sat with his lower jaw and forehead softly lying on the head.
- A spectrophotometric scan was done.

The outcome of this method states-clustering study of five different skin shade tabs [17].

Shade guide for silicone maxillofacial prosthesis

Anita, et al. in 2013 created an intrinsic shade guide for silicone maxillofacial prosthesis which had groups differentiated by yellow, red and blue basses survey which was cross-sectional in nature was carried out on a number of 100 randomly picked Indians for skin shade simulation with the help of guide [18].

Aparajita, et al. In the year 2014 conducted a study among all the different materials used for fabrication of maxillofacial prosthesis. It gives us a scope to adapt with the fields where the maxillofacial materials need improvement to provide the individual the maxillofacial prostheses which is of best quality [19].

Rani proposed a systematic review within the range of the given data with respect to shade simulation in

prosthesis made for maxillofacial defects. An electronic search reviews was limited to english and literature in dental was run through to isolate the articles which were relevant based upon shade matching and colouring in prostheses for maxillofacial defects. The articles published before December 2015 was all included in the study [20].

Accuracy of contacting and no contacting measuring systems

This method was given by Hu, et al. Its purpose was to compare the accuracy of contacting and no contacting measuring systems.

- 23 mm in diameter approximately differing in translucency, twenty four thick MFE (Maxillofacial elastomers) were made.
- A-2000, a platinum silicone elastomer (factor II) mixed with five pigments, *i.e.*, tan, black, red, yellow and titanium dioxide powder.
- Five instruments were utilized, and colour of each elastomer was measured three times by each instrument examined.

The no contacting measurement device performs differently in terms of accuracy within restrictions of this study; although when contrasted in terms of precision with a method for measuring contact was the outcome of this method [21].

Mobile colorimeter

To illuminate the samples to be tested, the entire assembly, including the jig and the illustrative mounted on it, to be placed in ambient light. Following that, colour of each sample was

Measured-HSV (Hue, Saturation, Value) adjustment, use of colorimeter application for mobile phones which is installed in a smartphone. Two-piece metal mould was closed by placing lid on it, clamping under pressure of 30 psi after gauging colour. Moulds were left at room temperature (21–28°C) for 24 hours for allowing the material to polymerize. Using the same application, the polymerized silicone samples were analysed again to determine colour alteration [21].

DISCUSSION

In patients using maxillofacial prostheses, colour matching to the surrounding skin is critical. It is critical to understand the various colour matching and colouring procedures used in maxillofacial prosthetics. The flaws visible in the maxillofacial region are produced by a variety of factors such as trauma, surgical intervention for malignant lesions, or congenital problems, but they have an impact on an individual's psychological and social health. In such cases, aesthetic maxillofacial prostheses not only repair the anatomical abnormality, but also restore the appearance of the face. The patient's psychological well-being. There are numerous things that must be present in order for the project to be successful. Among the maxillofacial prosthesis, "AESTHETICS" is the most important. Aesthetics of a Maxillofacial Prosthesis and aspects like retention and close adaption depends on the right shade match. The biggest challenge a maxillofacial prosthodontics can face is Colour Matching. The true representation of colour matching of the human physique plays a relevant role in making of a maxillofacial prosthesis and above all in maintaining the AESTHETICS which is the prime concern of people in today's world. And any changes in the facial appearance of people hampers their physical, psychological, social and psychosomatic health as well as such patients loses their confidence to stand in front of the world. A prosthesis which is designed for the correction of maxillofacial defects helps the patients to overcome all their problems and regain their confidence to stand back in the outside world. The materials used for the fabrication of maxillofacial prosthesis are acrylic resin and silicone and the addition of colorants gives colour to them.

CONCLUSION

Manufacturing of maxillofacial prostheses, colour matching is critical. In maxillofacial prosthetics, there are a variety of ways to match hue with facial skin. Introducing modern processes, colouring has become more precise and time-consuming.

Ranabhatt, et al. systematic study, published in 2017, is the most recent review in his field, and it correctly shown that the most prevalent methodology used for matching colours according to clinical practice is a trial and error approach. Nevertheless the amount of information available for coordination of colours for having a facial prosthetic is limited, there is no current analysis of the documentation that one procedure is preferable than the other.

Colour stabilization, which is provided by many approaches, requires more research because it is one of the key issues that dental clinicians encounter.

REFERENCES

1. Sathe S, Pisulkar S, Nimonkar SV, et al. Positioning of iris in an ocular prosthesis: A systematic review. J Indian Prosthodont Soc 2020; 20:345-352.
2. Pisulkar SK, Purohit H, Mistry R, et al. Encasing the encephalon: Enhancing psychosocial rehabilitation. Int J Cur Res Rev 2020; 12:129–134.
3. Nimonkar SV, Belkhode VM, Sathe S, et al. Prosthetic rehabilitation for hemimaxillectomy. J Datta Meghe Inst Med Sci Univ 2019; 14:99-102.
4. Belkhode VM, Nimonkar SV, Agarwal A, et al. Prosthodontic rehabilitation of patient with mandibular resection using overlay prosthesis: A case report. J Clin Diagn Res 2019; 13:10-13.
5. Anderson RR, Parrish JA. The optics of human skin. J Invest Dermatol 1981; 77:13-19.
6. Ranabhatt R, Singh K, Siddharth R, et al. Color matching in facial prosthetics: A systematic review. J Indian Prosthodont Soc 2017; 17:3-7.

7. Ouellette JE. Spray coloring of silicone elastomer maxillofacial prostheses. J Prosthet Dent 1969; 22:271–275.
8. Firtell DN, Bartlett SO. Maxillofacial prostheses: Reproducible fabrication. J Prosthet Dent 1969; 22:247252.
9. Schaaf NG. Color characterizing silicone rubber facial prostheses. J Prosthet Dent 1970; 24:198202.
10. Chalian VA, Majid AA, Leckrone WR. Milling machine for coloring heatvulcanizing silicone materials in maxillofacial prosthetics. J Prosthet Dent 1974; 31:7882.
11. Fine L, Robinson JE, Barnhart GW, et al. New method for colouring facial prostheses. J Prosthet Dent 1978; 39:643–649.
12. Aina TO, Wright SM, Pullen-Warner E. The reproduction of skin colour and texture in facial prostheses for Negro patients. J Prosthet Dent 1978; 39:74-79.
13. Hanson MD, Shipman B, Blomfield JV, et al. Commercial cosmetics and their role in the colouring of facial prostheses. J Prosthet Dent 1983; 50:818–820.
14. Ma T, Hicken SC, Buchanan CR, et al. Chair side colour verification for facial prostheses. J Prosthet Dent 1988; 60:219-221.
15. Over LM, Andres CJ, Moore BK, et al. Using a colorimeter to develop an intrinsic shade guide for facial prostheses. J Prosthodont 1998; 7:237–249.
16. Guttal SS, Patil NP, Nadiger RK, et al. A study on reproducing silicone shade guide for maxillofacial prostheses matching Indian skin color. Indian J Dent Res 2008; 19:191–195.
17. Wee AG, Beatty MW, Gozalo- Diaz DJ, et al. Proposed shade guide for human facial skin and lip: A pilot study. J Prosthet Dent 2013; 110:82- 89.
18. Sethi T, Kheur M, Coward T, et al. Change in colour of a maxillofacial prosthetic silicone elastomer, following investment in molds of different materials. J Indian Prosthodont Soc 2015; 15:153–157.
19. Aparajita M, Sunita C, Hemlata G, et al. Maxillofacial prosthetic materials- an inclination towards silicones. J Clin Diagn Res 2014; 8:ZE08–ZE13. [Crossref][Googlescholar][Indexed]
20. Hu X, Johnston WM, Seghi RR. Measuring the colour of maxillofacial prosthetic material. J Dent Res 2010; 89:1522-1527.
21. Nimonkar SV, Sathe S, Belkhode VM, et al. Assessment of the Change in Colour of Maxillofacial Silicone after Curing Using a Mobile Phone Colorimeter Application. J Contemp Dent Pract 2020; 21:458–462.