Pigments Used for Maxillofacial Prosthetics and A Step by Step Protocol for their Application

Tania Sethi[1], Jay Matani[2], Mohit Kheur[3], Shantanu Jambhekar[4]

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[1&2]Post Graduate Student
[3]Professor
Dept. Of Prosthodontics, M.A.Rangoonwala College of Dental Sciences and Research Centre, Pune

[4]Lecturer
Dept. Of Prosthodontics, Terna Dental College, Mumbai

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Email for correspondence:
drtaniasethi@gmail.com

ABSTRACT:

In Maxillofacial prosthetics, color matching is one of the most tedious tasks for the clinician. The color of a prosthesis plays a very important role, being one of the main factors contributing to the success of a prosthesis. Esthetic value of this artificial part of the body comes from its ability to fit well and merge into the surroundings of the skin and other anatomical structures making it unnoticeable to the onlooker. This can be made possible by selecting the right technique of coloring the silicone and the appropriate pigments along with clinical skill and experience. This article gives a step by step guide helping the clinician understand the technique and importance of every step in color matching.

Key words: Maxillofacial silicone elastomers, Prosthesis, Pigments, Shade matching

INTRODUCTION:

Maxillofacial prostheses are used for rehabilitating defects of body parts that may congenitally absent, resected due to tumors or lost as a result of trauma and burns. The uniqueness of silicone extraoral prostheses lies in their biocompatibility, durability, elasticity, surface texture and most importantly, their ability to be coloured to patients' skin shades.[1-4] All these properties contribute to giving the prosthesis a 'life like' look making it unnoticeable to the onlooker and at the same time, comfortable for the patient. A critical aspect in achieving an esthetically pleasing prosthesis is correct shade matching. Adding the correct pigments in the desired amounts to match the skin of the patient into which the prosthesis will blend is necessary to obtain the required skin tone. The prosthetist requires skill, a good color perception and experience in getting the right shade in the prosthesis. There are no guidelines in the literature regarding the procedure for colouring

of silicones. This article deals with the step by step procedure and protocol to mix the pigments with silicone elastomers in order to achieve the desired skin-shades.

DIFFERENT PIGMENT COLOURING SYSTEMS:

Various types of pigments are available, each having their own set of advantages and disadvantages. The clinicians' preference depends upon experience, handling, colour stability and availability of the pigment.

The different pigments are:

1. Dry pigments: These are in the form of powders (Fig. 1).
2. Pigments suspended in silicone oil (Fig. 2).
3. Pigments in pastes: Commercially available pigments are based on makeup systems used in the cosmetic and film industries as these have been tested for skin allergies.

Pigments are also classified as Intrinsic and Extrinsic pigments and Organic and inorganic pigments.

INTRINSIC PIGMENTS:

The pigments which are added and mixed into the silicone before curing are called intrinsic pigments. (Fig. 3) These cure with the silicone and hence cannot be rubbed off easily. The basic shade of the prosthesis must be achieved by intrinsic coloration as extrinsic colouring can change the look of the prosthesis only to some extent.

The pigments are inorganic earth pigments. They can be in the powdered or liquid form. The latter are called Master colours and are basically the powdered pigment mixed in silicone oil. (Fig. 4)

Flocks and Veins can also be added to enhance the look of the prostheses. Flocks are nylon fibres .They help in providing a 'life like' appearance and texture. Flocks are available in various shades and are added in minimal quantities only as they have been shown to influence the mechanical properties of the elastomers significantly.[5.6.7] Veining fibres can also be added to give the prosthesis a darker or bluish hue resembling veins in particular areas.

EXTRINSIC PIGMENTS:

Externally added pigments after curing the prosthesis are called extrinsically applied pigments.

These are physically applied onto the prosthesis with the help of a brush (Fig. 5). This is done in the presence of the patient so that the final colouring can be made to match the patient's skin tone as far as possible. A single component silicone is added to seal the pigment down into the silicone. Commercially available sealants (Part A and Part B- Technovent Ltd., South Wales, U.K) can also be used for the same purpose.

They are used to give a final finish and detailing to the prosthesis. Manipulation of the colour of the prosthesis is kept to minimal by this method. They are mechanically bonded to the silicone and hence there is degradation of the colour with repeated handling, cleaning and direct exposure to environmental factors.

Pigments bring life to the prosthesis. A trained and experienced Prosthetist is able to incorporate the right pigments in the precise proportion in order to get the optimal shade for the prosthesis.

A STEP WISE GUIDE TO COLOURING SILICONE ELASTOMERS:

A) STEP 1: BASIC REQUIREMENTS:

Some essential requirements before starting the process of color matching are

1) Light source: The preferable light source to colour silicone is normal day light or a CRI (Color Rendering Index) of 100.Indirect sunlight by sitting close to a window is recommended.[8]
2) Seating: The patient and operator must be seated close to each other so that the operator can keep checking the shades with the respected section of skin of the patient while mixing.
3) Work area: The work area should be well lit, clean and all equipment and material should be assembled and accessible to the clinician to avoid any problems while mixing.
4) The silicone is mixed on a white background to provide visibility of colours and adequate contrast.
5) The patient's skin is cleaned with a soap solution and dried.

The pigments are dispensed in small amounts to avoid over loading of pigment (Fig. 6).

B) STEP 2: STUDYING THE SKIN TONES:

The next step is to carefully assess and study the different skin tones of the area surrounding the defect as well as the contralateral orbit/ear/ part of the nose. These can be divided into various parts for convenience and ease of understanding by the operator. For example, in Fig. 7, the ear is divided into different parts.

C) STEP 3: MIXING OF THE SILICONE:

Silicones are inherently transparent (Fig. 8). Pigment incorporation is started by addition of white pigment to make the translucent silicone opaque. Pigment loading, which is addition of other colour pigments, also adds opacity to the mix.

The base colour should be obtained first. This is the color chosen from the surrounding skin and is the one which will help the prosthesis blend into the natural skin. Other skin tones are obtained by adding pigments to this base color to give it other shades like those to highlight the lobe, helix and other prominent parts. (Fig. 9)

For an Asian skin tone, following the white pigment, a few drops of brown, umber and sienna are added. Alternately ready- made skin shades are available which can be selected and added to the elastomers to get a desired colour. Pigments are loaded little by little to avoid excessive pigment which will lead to the mix not matching to the extent that it needs to be discarded. Verification of the color is done in two ways - Taking a bulk of the color on the tip of the spatula (Fig. 10) or some material is placed between plastic polythene sheets.[8] Some clinicians are of the opinion that a thinner layer as that pressed within the polythene sheets in contrast to the bulk on the spatula gives a more accurate idea of the shade of the color. A second opinion from an assistant clinician is always helpful.

Other methods that have been used over the years for colour matching are as follows:

1. Photographs: Photographs are a valuable source of the skin tone of the patient in their absence. But this has drawbacks with respect to the conditions in which the photograph was taken, the quality, lighting and printing.
2. Pre constructed tissue shade guides: Shade guides can be made using specific formulations of pigments.[8] These can be used to attain the closest shade of the skin of the patient and a few modifications can be made to get the final colour. These have to be replaced yearly due to colour degradation.
3. Devices to assist colour matching: Colorimetric and Photometric techniques have been successfully used to assess the amount of pigment needed to match a particular skin colour.[9-11] For example, a spectrophotometer (Spectromatch, Spectromatch Ltd., London) may be used. (Fig. 11). The operator records colors in different areas with the help of this device. The software gives details of the composition of the shade of the skin- the color and amount of pigment to be added to attain the specific shade. These machines are not fully reliable as they are technique sensitive and are expensive compared to visual shade matching procedure.[8] They require the aperture of the sensor to adapt to the skin completely and prohibit any external source of light which could affect the reading. On the other hand, these systems help reduce the possibility of metamerism (records tissue colour under three different light sources to match all light conditions), help reproducibility and reduces chair side time.
4. Colour charts: Colour charts used by the photographic and paint industry have been used but have not been very successful.

D) PACKING THE MOULD:

The different skin tones obtained by mixing different pigments are carefully loaded into the corresponding areas of the fabricated mould. (Fig. 12) It is very essential to check at every step the correct position of loading these pigments. The junction between two different shades must be merged carefully to avoid a prominent demarcation in the final prosthesis. After curing the prosthesis is extrinsically coloured and fitted onto the patient. (Fig. 13)

CONCLUSION:

This article provides an overview of the guidelines to obtain optimal shade matching with silicone Elastomers during various steps in fabrication of the maxillofacial prosthesis.

Fig. 1: Dry Pigments

Fig. 2: Master colours-Pigments suspended in silicone oil

Fig. 3: Intrinsic colouring of silicone

Fig. 4: Pigments for intrinsic colouring (Technovent Limited, Wales,UK)

Fig. 5: Extrinsic colouring of silicone with a brush

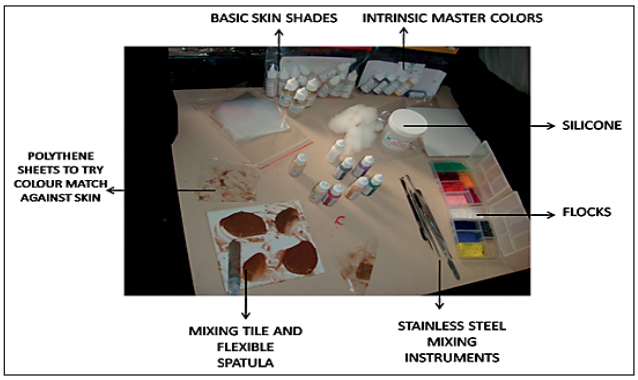

Fig. 6: Dispensing of Pigments and working area

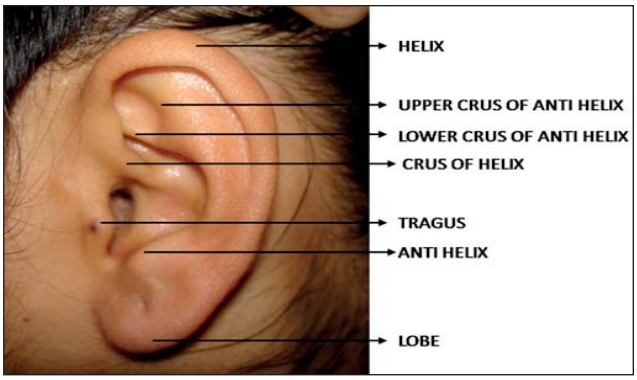

Fig. 7: Different parts of the ear

Fig. 8: Translucent silicone elastomer as dispensed

Fig.9: Separation of base shade into various colours

Fig. 10: Evaluation of shade with the skin

Fig.11: Spectromatch system (Spectromatch Ltd., London, UK)

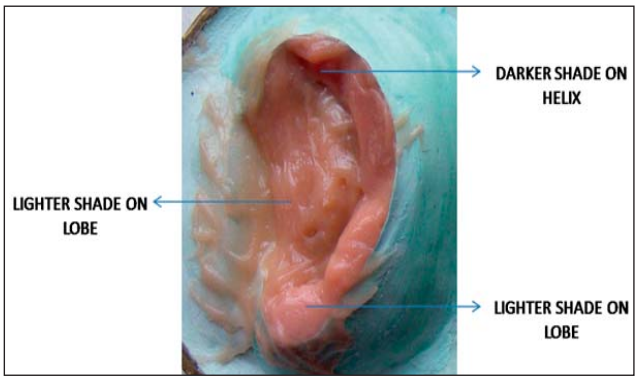

Fig. 12: Packing of the mould with different shades

Fig. 13: Finished prosthesis

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