CASE REPORT

Finger prosthesis: a boon to handicapped

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Dr Lakshya Kumar,
lakshya79@yahoo.com**SUMMARY**

This is a clinical case report of a 52-year-old male patient with four partially missing fingers of the left hand. The article describes the clinical and laboratory procedure of making prosthesis with modern silicone material. A wax pattern was fabricated using the right hand of the patient. A special type of wax was formulated to make the pattern so that it can be easily moulded and carved. Intrinsic and extrinsic staining was also performed to match the adjacent skin colour. The patient was given the finger prosthesis and was asked to use a half glove (sports) to mask the junction between the prosthesis and the normal tissue. It also provides additional retention to the artificial fingers. The patient felt his social acceptance improved after wearing the finger prosthesis.

BACKGROUND

The general inadequacy of hand prosthesis underlines the importance of utmost conservation whenever hand amputation is under consideration. The common causes of hand injuries are machines, hand tools, explosives, cutting tools and motor vehicle accidents. Industries such as metal furniture, stamped and pressed metal products, slaughtering and meat packing pose great risk of hand injuries.¹ Majority of the industrial accidents are more due to personal factors—stepping or striking against objects, falls cuts or handling of materials without machinery. Research has shown their relation to age, experience, responsibility and general health of the employee and to factory condition of hours, fatigue, atmosphere and lighting.

The success of any prosthesis depends on many factors, including the extent and location of the defect.² Once a part of a body is amputated, it is difficult to get the same result even after plastic surgery. Cases where there is no surgical prognosis

are usually referred to a prosthetist, mostly for aesthetic purpose. By the time the injury heals, most of the patients usually adapt socially, psychologically and emotionally. They learn to do their work in one way or the other. It is mostly for social purpose, they seek help at a later stage. The ability of a prosthodontist to fabricate a life-like prosthesis made of silicone is well known. The skill and experience in impression making and sculpturing usually pays off when unusual cases seek help.

CASE PRESENTATION

A male patient, aged 52 years, reported to the prosthodontic outdoor patient department, with a history of traumatic loss of three fingers of the left hand excluding the thumb and paralysis of little finger, about 7 years prior, due to his occupation. History reveals patient had suffered a long period of psychological depression immediately after the injury. Medical history was unremarkable except he has been taking antidepressants for many years. Clinical examination of the hand revealed a nerve injury to the little finger of the left hand, due to which patient could not move the little finger voluntarily (figure 1).

TREATMENT**Impressions and pattern fabrication**

A diagnostic alginate impression was made in a two layer modelling wax, custom tray which was perforated and extent of the tray determined by the proposed prosthesis design (figure 2). The impression was poured with dental stone. At the same appointment another impression was made of patient's right hand in a combination of light body and putty. The impression of the patient's right hand was poured with wax, which was made by mixing of two sheets of bees wax, one sheet of hard pink base plate wax and two strips wax, of clear rope

Figure 1 The defect. **Figure 2** Impression of the remaining stump.

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boxing wax. The resultant wax is pliable enough to form into small shapes with fingers when warm, yet stiff enough to carve with an instrument when chilled.³ The pattern was removed from the elastomeric impression (figure 3). The wax pattern was then adjusted and adapted on the working cast for the left hand that was made initially. Approximate length and angulations were determined on working cast and later confirmed during the trial of wax pattern.

Try in of the wax pattern

There were few problems associated when we used the same patient's other hand to make the wax pattern. One was the length and the other was the angulation of the artificial fingers. But they can be easily overcome when a pliable wax pattern is made. The length and angulation can be easily adjusted by superimposing the two casts at one level using the same anatomical landmarks on the inner side of the palm or the wrinkles of the palms. The two casts were indexed so that they can be oriented again in the same position. The wax pattern was tried on the patient's left hand (figure 4). Necessary adjustments were made especially at the margins. While adjusting care should be taken not to touch the wax surface with hands otherwise, the pattern will lose surface details. Placing it in chilled water for some time prevents distortion of the pattern. Preserving the rubber impression is beneficial at times as it can be used to impart the surface details on the pattern after necessary trial adjustments.

Fabrication of the mould

The master cast was duplicated and the duplicate cast was used for investing. The pattern was sealed to the master cast at the junction, where the margins of the pattern overlap the cast. The pattern and the cast were then invested in a large size Hanau flask. The mould was first poured only up to half of the pattern. Separating media was applied and then the other half was poured, wax was eliminated in the conventional way. The mould is then coated with tin foil substitute as it leaves a smooth, matt finish on the surface of the prosthesis.

Intrinsic and extrinsic colouration

Unfortunately, silicone prostheses do not have colour longevity. Lewis and Castleberry⁴ stated that the ideal colour properties required in a maxillofacial prosthetic material must accept and retain intrinsic and extrinsic colouration, and that the appearance and mechanical strength of the prosthesis must not be changed by sunlight or other environmental factors. Colour

instability of the prosthesis may be attributed to ultraviolet light exposure, air pollution, cosmetics and the use of strong solvents to clean the prosthesis.⁵⁻⁷

The mould cavity was prepared by first coating the external tissue surface area with a thin coat of catalysed uncoloured silicone material. Hair dryer was used to partially polymerise the first clear layer. Then selected characterisation colours were mixed with the silicone polymer and painted on the surface of the clear layer. A base colour mixture of the silicone material was prepared to fill the mould cavity. Kaolin powder was added to provide the radiopacity. Then silicone catalyst was added after satisfactory base colour was developed. Air was removed from the mixture by placing the container in a bell jar under vacuum. The coloured, catalysed, airless silicone base was then placed into the mould cavity. The two pieces were reassembled and excess silicone was expressed using light pressure. The mould was then clamped and placed into a dry heat oven at the manufacturers prescribed time and temperature.

After polymerisation, the mould was allowed to cool at room temperature, opened and flash removed with a sharp scalpel and finished with an abrasive stone. The prosthesis was tried in the patient. Extrinsic stains carried on a silicone adhesive were added on the dorsal surface of the prosthesis to increase the colour intensity on that surface. This was achieved by extrinsic staining where a silicone adhesive acts as a carrier for the pigment. Pigments were mixed with silicone adhesive and applied to the surface of the prosthesis with a finger tip in a patting motion. This allows a build up of colour intensity.

OUTCOME AND FOLLOW-UP

The prosthesis was finally delivered to the patient after giving instructions regarding its maintenance (figure 5). Chances of discolouration were there and they were overcome with external staining. The patient appreciated the prosthesis as this improved his social acceptance because of its life-like appearance.

DISCUSSION

Involving the little finger posed a problem as that finger would always have pointed down. Multiple impressions are necessary and every impression should extend to normal part of the hand also. Elastomers provide fine details that can be used for characterisation. Using the same person's unaffected hand eliminates the errors in respect to size and shape. Wax was preferred over clay to make the pattern because residual oils from clay contaminate the mould surface, which interferes with the platinum catalyst employed in silicone prosthesis materials. All the three

Figure 3 Wax pattern.

Figure 4 Wax pattern trial.

Figure 5 Final prosthesis.

fingers were joined together for retention but the discrepancy in blending, at the margins is quite obvious which was overcome by asking the patient to wear a half glove that is used in sports. This not only masked the margins but decreases the possibility of accidental fall of the prosthesis. The colouring of silicone is a technically sensitive procedure. The intensity of the non-polymerised silicone matched the one but after polymerisation the same shade looked light, so external staining was also performed.

All modifications contributed to the fabrication of an aesthetically and functionally acceptable prosthesis without the invasion involved in implant or magnet retained prosthesis. The method of achieving suctional retention by overlapping the stump is useful when some part of the phalanx remains. In cases of a shorter residual finger, adhesives or other retentive devices may be required to hold the prosthesis.

Hollowing out the solid wax finger is cumbersome and needs multiple alterations during adaptation to the stump, as the overlapping part has to be kept very thin to avoid looking unaesthetically bulky. Earlier, various materials like acrylic resins and polyvinyl chloride were used to fabricate the finger prosthesis but rejected due to suboptimal appearance and lack of stain resistance. Acrylic resins are uncomfortable due to lack of flexibility, though they are cheaper.

Fabric reinforcements sandwiched between layers of silicone add significant tear resistance and allow thin, nearly transparent margins. Careful modification of the positive model enhances

the overall result.⁸ The overall durability and resistance of silicone is superior to any other material currently available for finger restorations with the functional benefit of the gentle, constant pressure applied by the elastomer helping to desensitise and protect the injured tip. Over time, scar tissue contained within the silicone prosthesis becomes more pliant and comfortable.

Learning points

- ▶ Silicon finger prosthesis is a boon to patients suffering from psychological trauma after loss of the fingers.
- ▶ The aforementioned procedure of modified impression reduces the chair time as well as it saves the material so this methodology can be termed as economical.
- ▶ Only limited functions can be performed by this type of prosthesis; we recommend an implant as a retentive aid to improve function.

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Competing interests None.

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REFERENCES

- 1 Wilkes R. A social and occupational study of injured hands. *Br J Ind Med* 1956;13:119.
- 2 Finlay PM, Sautar DA, Tiwari R. Excision and reconstruction in head and neck cancer. New York: Churchill Livingstone, 1994:113–16.
- 3 Taylor DT. Clinical maxillofacial prosthetics. Quintessence Publish, 2000:237–8.
- 4 Lewis DH, Castleberry DJ. An assessment of recent advances in external maxillofacial materials. *J Prosthet Dent* 1980;43:426–32.
- 5 Chen M, Udagama A, Drane JB. Evaluation of facial prostheses for head and neck cancer patients. *J Prosthet Dent* 1981;46:538–44.
- 6 Jani RM, Schaaf NG. An evaluation of facial prostheses. *J Prosthet Dent* 1978;39:546–50.
- 7 Hanson MD, Shipman B, Blomfield JV, et al. Commercial cosmetics and their role in the coloring of facial prostheses. *J Prosthet Dent* 1983;50:818–20.
- 8 Michael JW, Buckner H. Options for finger prosthesis. *J Prosthet Orthot* 1994;6:1:10–19.

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