A Technique of fabricating acrylic finger prosthesis with silicone veneering – A clinical innovation

Chandan Kumar Kusum, Shivi Khattri*, Indrajeet, Nishant Kumar Tewari

Email: shivikhattri123@gmail.com

Abstract

Finger defect severely jeopardizes the day-to-day life activities of an individual by affecting the aesthetics and function of his/her hand. Replacing a lost finger rehabilitates the patient back to the society. Commonly used materials for fabricating these prostheses include acrylic and silicone. Acrylic prosthesis has the main advantage of being highly durable but its less life-like appearance bars the patient from its use. On the other hand, silicone prosthesis has superior aesthetics but its low durability forces the patient to visit the maxillofacial clinic periodically seeking its replacement. With these limitations in view, this article presents a successful prosthetic management of a patient having a partial amputated thumb where a glove type acrylic stem was fabricated and veneered with silicone to incorporate the advantage of both acrylic and silicone. The final outcome of this treatment resulted in an improved function and aesthetics thereby elevating the self-confidence of the patient.

Key words: Amputated finger, glove prosthesis, mechanical retention, prosthetic finger

Introduction

Fingers have a vital role in accomplishing daily activities, its loss due to an accident, congenital defect or a tumour, bring psychological and functional derangement to the patient and his social life, and this makes rehabilitation procedures for achieving aesthetic and functionality a very challenging task.1,2,3 Microsurgical reconstruction of any defect is often linked to its own limitations in terms of an aesthetic outcome and its feasibility [4]. Prosthetic reconstruction remains a treatment option to rehabilitate such cases. The common materials employed for fabricating prosthesis for rehabilitation are either acrylic or silicone. Both these materials have their own advantages and disadvantages.1,5-11

This article describes a case report of the prosthetic management of a patient with an amputated thumb where a glove type acrylic stem was fabricated and veneered with silicone to incorporate both the advantages of acrylic and silicone. This also enhances the resiliency of the prosthetic finger.

Case history

A 62-year-old male patient was reported to the Department of Prosthodontics of Subharti Dental College and Hospital, Meerut, with the chief complaint of missing the digit of his left hand. The patient had covered his left hand in a towel to hide the defect. History revealed that he had lost his left thumb due to an accident four years back.

On examination, it was found that the amputation was partial, involving the distal phalanges of the left thumb. The wound was completely healed and the surrounding stem showed no signs of inflammation and infection. Patient was motivated and educated about the implant and mechanical means for retaining the prosthesis. But due to economical limitations and unwillingness in getting involved with any surgical procedure, he opted for mechanically retained prosthesis. The limitations of the prosthesis were

How to cite this article: Chandan Kumar Kusum, Shivi Khattri, Indrajeet, Nishant Kumar Tewari (2019). A Technique of fabricating acrylic finger prosthesis with silicone veneering – A clinical innovation. MJDS. 4(2), 18-22.
explained to the patient, and after obtaining his consent, the following procedures were undertaken.

**Steps involved in fabrication**

1. An impression of the defective thumb was made with a rubber base putty impression material (Flexceed, GC Corp, India) and poured with type III dental stone (Kal Rock, Kala Bhai Karson Pvt, Mumbai, India).

2. An impression of contralateral normal thumb was made by inserting the thumb in a relaxed state into a plastic glass filled with irreversible hydrocolloid impression material (Algitex Alginate Impression Material, The Bombay Burmah Trading Corporation, Mumbai, India).

3. The impression was cut into two halves, separating the dorsal and ventral parts. Then, a layer of modelling wax (HIFLEX-Modelling Wax, PrevestDenpro Limited, Jammu, India) was poured onto its walls and the two halves of the impression were reassembled in order to retrieve a single piece hollow (glove type) wax pattern of prosthesis [Figure – 1].

4. With the help of a blow torch, a hollow wax pattern was slightly softened from the tissue ward side, for easy sliding of the wax prosthesis over the amputated stump for trying [Figure – 2].

5. A small opening was made at the distal end of the dorsal surface of wax pattern, and a thin mix dental stone (Kal Rock, Kala Bhai Karson Pvt, Mumbai, India) was filled into it. It was then oriented over the amputated finger cast. After dewaxing the finger stump, the cast was separated and reduced 0.5mm to 1mm all over and replaced [Figure – 3]. Intrinsic stains (Camel artists oil colour, Camelin Ltd, Mumbai, India) were added to clear the heat polymerizing acrylic resin material and packed into the mould.

6. The acrylic finger was retrieved and finished, and then a rubber base putty index was made over it, so as to form a negative replica of the lines and grooves present on the prosthesis. The putty index was extended from the acrylic substructure over to the stone cast and also over the nail part of the substructure. This was done in order to achieve a positive seat while packing silicone over the acrylic substructure [Figure – 4].
7. The acrylic finger was reduced approximately 1mm all over except over the nail in order to gain space for the silicone veneering [Figure – 4].

8. Colour corrected RTV silicone (Multisil RTV, MP Sai Enterprises, Mumbai, India) was packed over the acrylic substructure in the resultant space.

9. The packed mould was allowed to polymerize at room temperature for 24 hours before retrieving the final finger prosthesis having a silicone outer veneer over the acrylic substructure like a glove.

10. The silicone veneer was carefully removed from the acrylic stem, finished, and reattached using cyanoacrylate resin (Feviquick, Pidilite Industries Ltd, Uttar Pradesh, India) 13. [Figure – 5].

Discussion
Beasley (1987) noted that an individual who keeps their hand hidden inside their pocket due to embarrassment over its appearance is as functionally disabled as a forequarter (scapulothoracic) amputee. Severe hand dysfunction and social unacceptance are the two degrading factors for a patient with a loss of finger. For getting rehabilitated prosthetically, options available include implant retained and mechanically retained prosthesis. Implant retained prosthesis has a limitation of surgical procedure being involved for implant placement and the cost factor associated with the implant and its implantation procedures. So, for rehabilitation cases where implant placement is not possible, mechanically retained prosthesis becomes a more feasible option. Acrylic being the most common material available for fabricating any maxillofacial prosthesis, it has the advantages of being biocompatible, durable, economical, and a familiar material to maxillofacial prosthodontists, but its disadvantages include a less life like appearance and a lack of resiliency. In the present era, silicone has outnumbered acrylic from the field of maxillofacial prosthetics. Though it has a life like appearance, their limitations include low durability, low edge strength, microbial growth, weak retention, and instability. To overcome the disadvantages of both silicone and acrylic, we designed a prosthesis having an acrylic substructure with a silicone veneering. Cyanoacrylate resin (instead of regularly available primers) was used as an adhesive between the silicone and the acrylic substructure. In the invivo study conducted by Shetty US et al., though the author found cyanoacrylate resin adhesive having a less bond strength compared to that of the bond strength of the two primer (G-611, A-330G) used in this study, he also explained the different variables that may affect the bond strength (surface characterization, effect of outdoor weathering, and colour pigment added to silicone). He concluded that the cyanoacrylate resin has a satisfactory bond strength and it can be used as a chairside bonding agent. Further, if we compare, the insertion and removal of other maxillofacial prosthesis like ‘silicone ear attached to the acrylic substructure’, with one presented in this article, the debonding force acting at the junction of acrylic

![Figure 4: Thumb mold formed after dewaxing.](image-url)

![Figure 5: 5A: Thumb stump reduced 0.5mm – 1mm all over. 5B: Reduced acrylic finger with rubber base putty as index. 5C: Glove type silicone finger prosthesis with acrylic substructure delivered.](image-url)
and silicone while inserting and removing the finger prosthesis is not perpendicular to the surface of the acrylic substructure as is there with the auricular prosthesis, it in turn reduces the chance of debonding between the acrylic and silicone in case of the finger prosthesis compared to the other maxillofacial prosthesis with a similar design situation. Also, as the increase in the cost of prosthesis with the use of primer may be of concern in cases where financial constraint exists, cyanoacrylate resin adhesive, though not ideal, can be considered useful to rehabilitate such finger amputated cases. The design of the acrylic substructure with silicone veneering had the advantage of a low microbial growth as the silicone was not in contact with the amputated stump, which increases its durability. Also, a more life like appearance was obtained due to the silicone veneering over the acrylic substructure that gave prosthesis a texture and resiliency as that of a natural finger. The limitations for this unique prosthetic design include the involvement of extensive laboratory procedures for its fabrication. The long term effect of cyanoacrylate resin on both acrylic resin and silicone elastomer, along with its mode of bonding, is still needed to be explored through studies. Precautions that must be followed to ensure a good prognosis of this prosthetic design are: before packing silicone over the acrylic substructure and while adhering silicone with the acrylic, the acrylic substructure must be thoroughly cleaned first with water followed by acetone and then left to air dry, as this will provide a clean acrylic surface to improve the bond strength of the adhesive used between the silicone and the acrylic; while packing the silicone, care should be taken by the operator to minimize void incorporation into the silicone mixture as this will reduce the chance of cohesive failure caused by tearing of the silicone part of the prosthesis; while inserting the prosthesis, the patient must first insert the metal ring into the finger stump and then gently slide the finger prosthesis over the finger stump followed by sliding the metal ring onto mask the junction between the acrylic and silicone, and in a similar manner, while taking off the prosthesis the patient should first slide and disengage the metal ring from the prosthesis and then remove the prosthesis gently from the finger stem in order to minimize unfavourable debonding forces acting at the junction between the acrylic substructure and the silicone veneer.

**Conclusion**

Any maxillofacial prosthesis including the finger prosthesis is normally considered to have a life span of 1.5 – 2 years, though some individuals may be able to maintain it for a longer period of time. However, as a general rule agreed among all, it is in need of replacement every 5 years. Because of this limitation, the cost factor involved in fabricating any prosthesis will also play a significant role in the decision making of the patient in order to seek a prosthetic rehabilitation. Cost effective and at the same time acceptable cosmetics and functional qualities are the prime concerns for the patient in accepting finger prosthesis. This paper describes a technique to fabricate finger prosthesis with a unique design and within acceptable economic limit, which resulted in an improved function and elevated self-confidence level of the patient. Thus, a finger prosthesis having an acrylic stump with silicone veneering will add a valuable alternative into the armamentarium of maxillofacial prosthodontics in targeting such cases.

**References**

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