RESEARCH PAPER

Prosthetic Rehabilitation of a Finger Amputation Using High-Temperature Vulcanizing Silicone: A Case Report

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Abstract

Background: Finger amputations can result in significant functional, psychological, and esthetic challenges for patients. Silicone finger prostheses provide a conservative and minimally invasive option for restoring the appearance and selected functions of an amputated digit. High-temperature vulcanizing (HTV) silicone is particularly useful because of its strength, durability, flexibility, and ability to achieve lifelike skin characteristics.

Case Report: This case report describes the prosthetic rehabilitation of a patient with a finger amputation using an HTV silicone prosthesis. A detailed clinical assessment was performed to evaluate the residual digit, surrounding tissues, interphalangeal relationships, and prosthetic requirements. An impression of the affected area was obtained, and a custom prosthesis was designed and fabricated using HTV silicone. The prosthesis was intrinsically and extrinsically characterized to reproduce the patient's natural skin color, texture, and anatomical contours. The completed prosthesis was fitted and evaluated for retention, comfort, esthetics, and functional acceptability.

Results: The fabricated HTV silicone finger prosthesis provided satisfactory restoration of the missing digit in terms of shape, color, and surface texture. The patient demonstrated good adaptation to the prosthesis, with improved esthetic appearance and enhanced confidence in social situations. The prosthesis also provided limited functional assistance by restoring the contour and protective role of the missing finger.

Conclusion: HTV silicone can be effectively used for the fabrication of customized finger prostheses following digital amputation. Careful clinical evaluation, accurate impression making, anatomical sculpting, and appropriate silicone characterization are essential for achieving a natural and satisfactory outcome. Silicone finger prosthetic rehabilitation represents a valuable non-surgical treatment option for patients seeking esthetic and functional restoration following finger amputation.

Keywords: Finger amputation; Finger prosthesis; High-temperature vulcanizing silicone; Silicone prosthesis; Maxillofacial prosthetics; Prosthetic rehabilitation; Digital prosthesis; Esthetic rehabilitation; Anaplastology.

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Introduction

The hand plays an essential role in grasping, holding, manipulating and performing activities of daily living. Fingers also contribute substantially to the appearance of the hand and to non-verbal communication. Partial or complete loss of a finger may therefore produce both functional and psychological consequences. Finger amputations may occur as a result of trauma, congenital anomalies, infection, tumors or surgical intervention1.

The rehabilitation of a partially amputated digit can be accomplished by surgical reconstruction or prosthetic replacement. Although microsurgical reconstruction and replantation can provide biological restoration in selected cases, these procedures may not always be feasible because of the extent of injury, delayed presentation, availability of facilities, financial considerations or patient preference2. Prosthetic rehabilitation therefore remains an important treatment option for patients with partial finger loss.

The present case report describes the rehabilitation of a partially amputated right middle finger using a custom-made silicone finger prosthesis with mechanical retention, with the primary objective of improving finger function and restoring the missing anatomical form2,3.

Case Report

A 55 year-old male patient reported to the Department of Prosthodontics with the chief complaint of a partially missing right middle finger and difficulty in performing normal hand functions.

The patient had a history of traumatic amputation involving the right middle finger 4 years ago due to machine injury. Clinical examination revealed partial absence of the digit, with approximately half of the finger missing. The amputation site was completely healed, with no signs of inflammation/infection. The amputation was at the level above the interproximal phalangeal joint of the middle finger.

The remaining fingers and the contralateral hand were examined to determine the appropriate dimensions and anatomical morphology for the proposed prosthesis. After clinical examination and discussion of available treatment options, a custom-made silicone finger prosthesis was planned4. The patient was informed about the advantages and limitations of a silicone finger prosthesis.

Procedure

The affected hand was prepared for impression making. Care was taken to obtain an accurate reproduction of the residual middle finger, adjacent fingers and surrounding hand anatomy to obtain a working model.

An impression of the contralateral middle finger was also obtained to serve as an anatomical reference for the fabrication of the missing portion. The impressions were made using irreversible hydrocolloid and poured using dental stone to obtain accurate working casts5.

The contralateral middle finger was used as an anatomical guide for determining the appropriate length, width, contour and overall morphology of the missing portion6.

Diagnostic impression for the working cast

Working model on a neutral grey background

An impression of the contralateral (mirror-image) finger was recorded as the donor template. Molten modelling wax was poured to generate the wax pattern of the missing digit7. The pattern was hollowed internally to keep the prosthesis light and thin-walled. It was seated on the working cast and adapted to the stump.

Wax pattern replicated from the contralateral hand, over the defect area

The first pattern was carved with a Lacron carver and tried in on the patient. Fit, contour, orientation and — critically — length were assessed against the contralateral finger. The initial attempt was judged unsatisfactory; hand-carved surface anatomy lacked realism. Required corrections and the verified length were recorded before proceeding. The pattern was refined with an electric wax-carving pen to reproduce fine skin detail. Knuckle creases, lines of relaxation and nail-bed contours were developed8. The pen adds and flows wax precisely — detail unachievable with a Lacron carver alone. The refined pattern was re-verified for length and symmetry9.

Impression of the defect area

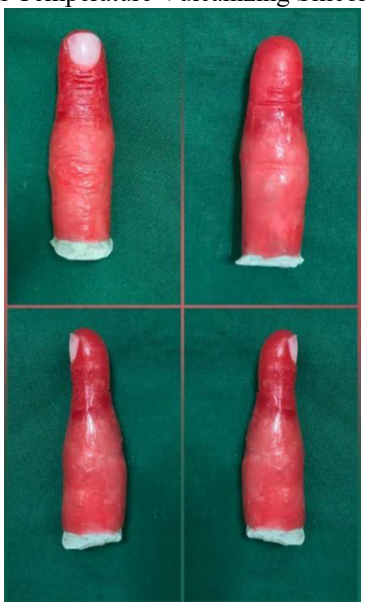
Close-up — unsatisfactory surface anatomy

Wax trial (Lacron carver) — unsatisfactory; height evaluated

Wax pattern rectified with the electric pen

Detailed anatomy achieved with the electric pen

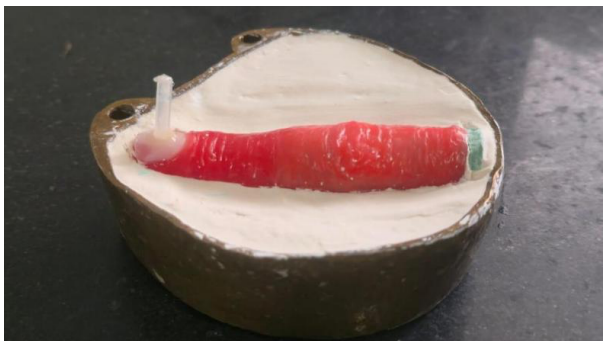
Because wax distorts on removal, the try-in length and anatomy were recorded first, then the pattern was sealed to the cast and carefully sectioned10. A nail bed was prepared and an artificial nail attached; an undercut retains the nail within the elastomer. The nail was indexed to hold its position accurately during flasking.



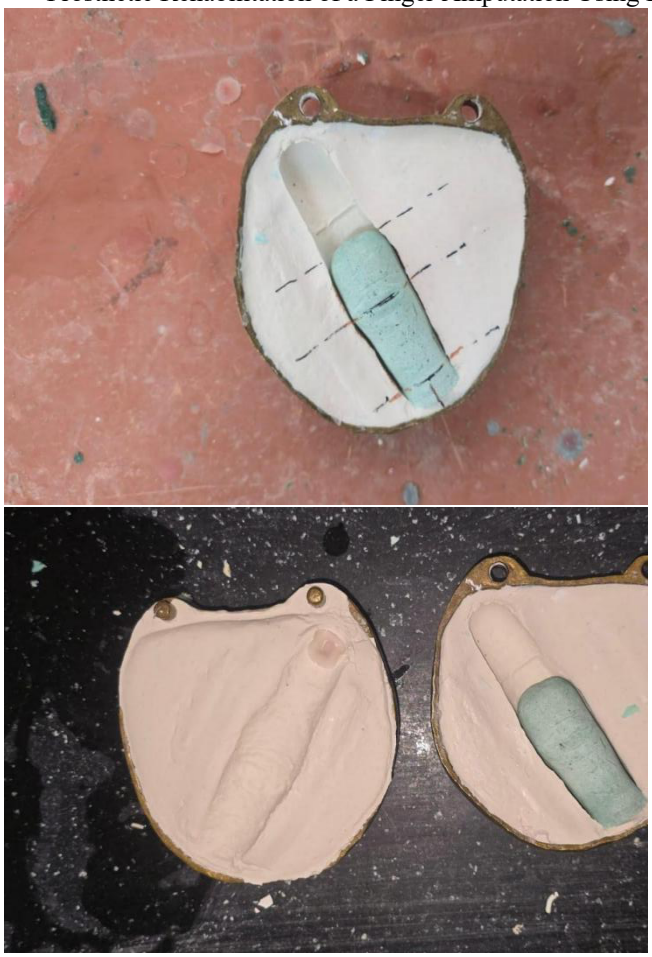
Sealed & sectioned pattern with nail (length verified at try-in)

Indexing of the nail before flasking

The wax pattern was invested in dental stone within a flask. A two-pour investment separated the dorsal and ventral halves and stabilized the stump. This layered mould permits easy silicone packing and independent colour control of each surface. The mould was dewaxed in a boiling-water bath until all wax was eliminated. The mould was opened and reorientation markings placed to guide accurate reassembly during packing. A separating medium was applied between mould halves before silicone was introduced.



Flasking of the wax pattern



Dewaxing complete — reorientation markings for packing

Technovent HTV medical-grade silicone was tinted intrinsically with Factor II pigments11. Dorsal and ventral surfaces were matched separately, in natural daylight. Multiple thin pigmented layers under clear silicone build translucency and colour depth. Shade was verified against the patient's adjacent skin before packing.The characterized silicone was packed into the mould under light pressure to express excess. The flask was closed and held under a bench press to fully adapt the material. Bench-press pressure was maintained for approximately one hour.The flask was left to cure overnight at room temperature. A final heat cure was given for 1 hour at 100 °C (HTV protocol).The prosthesis was deflasked, inspected and gross-finished.

Packing the silicone

Bench press (~1 hour)

Retrieval after overnight RT cure + 1 h heat cure at 100 °C

Surface detail was added chairside with Factor II extrinsic stains. Freckles, vascular tones, nail nuances and skin variegation were painted to blend with the hand. Colours were fixed with Technovent extrinsic sealant for durability. The prosthesis was finished, polished, and inserted onto the residual stump. Retention is by an airtight suction "cupping" of the stump, reinforced by a decorative ring. A ring at the metacarpo-phalangeal margin masks the junction line and aids retention12. Marginal adaptation, retention, comfort, aesthetics and satisfaction were all confirmed.

Fixing extrinsic colour with Technovent sealant

Final prosthesis in situ — ring masking the margin

Discussion

Partial finger amputation can have a considerable impact on both function and appearance. The loss of a portion of a digit reduces the available finger length and may interfere with grasping and manipulation of objects. It can also produce psychological distress.

Several treatment options are available for patients with partial finger amputation. Microsurgical reconstruction may provide biological restoration in selected cases however, prosthetic rehabilitation may be preferred when reconstruction is not feasible or when a patient seeks a less invasive and comparatively economical treatment.

Silicone has become an important material for aesthetic finger prostheses because it permits reproduction of the external morphology and colour of natural tissues. Jacob et al. reported the use of a silicone finger prosthesis as a

clinical option for partial finger amputation and emphasized the importance of retention for prosthetic success.

Similarly, Ahmad et al. described rehabilitation of a partially amputated index finger with a silicone prosthesis and highlighted retention as one of the major challenges associated with digital prostheses. Their technique used a copper ring as a mechanical retentive aid, eliminating the need for adhesive materials.

Yadav et al. also described a ring-retained silicone finger prosthesis for a patient with partial single-finger amputation. Their report emphasized that finger prostheses can provide functional and psychological benefits and described mechanical retention as a useful approach.

Patel et al. reported a silicone finger prosthesis using passive vacuum fit together with mechanical retention. Their report emphasizes that inadequate retention is one of the principal challenges in prosthetic replacement of partially amputated fingers and discusses mechanical retention as a practical option.

Reddy et al. described an acrylic finger prosthesis retained using a wrought-wire framework in a patient with partial index-finger amputation. Although acrylic was used rather than silicone, the report demonstrates the importance of designing retention according to the anatomy of the residual finger and the patient's clinical requirements.

In the present case, the use of a custom-made silicone prosthesis with mechanical retention allowed restoration of the missing portion of the right middle finger while avoiding more invasive treatment. The prosthesis was designed according to the anatomical form of the contralateral finger and customized to the patient's residual stump. The principal objective was functional rehabilitation, with restoration of the finger's length and contour contributing to improved grasping and handling of objects.

An important limitation of a conventional silicone finger prosthesis is that it generally provides passive rather than active movement. Therefore, although it can improve grasping by restoring the missing finger length and provide an acceptable external appearance, it cannot completely reproduce the movement and sensation of a natural digit. Nevertheless, for selected patients, a custom-made silicone prosthesis can provide a relatively simple and conservative method of rehabilitation.

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