

A versatile hand splint

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Abstract

Splintage plays a major part in the management and rehabilitation of the hand following injury, infection and operation. It is essential to have a simple, comfortable, and firm but flexible splint. This should be available "off the shelf", but be acceptable to the patient and to the treating clinician.

This paper will describe a splint which not only has these qualities, but is cheap and is re-usable after washing.

The splint is made of high density Plastazote and is available in two sizes for each hand. It is moulded into the shape of the functional position of the hand and can easily be trimmed with bandage scissors to give a precise fitting. The splint has been evaluated following surgery on fifty hands. Its fabrication, use and simplicity are discussed.

Introduction

Leading authorities in hand rehabilitation including Bunnell, Rank, Wackfield, Heuston, Wynn Parry and others have emphasized the importance of correct splintage for the recovery of hand function following operation, injury or infection.

Choosing a splint is very difficult. Clinicians have their likes and dislikes with regard to the varying characteristics of splints, but most will agree on the following criteria.

The splint should—

1. Maintain the hand in the position of comfort or the "position of function".
2. Allow the fingers as much mobility as is permissible in accordance with the disease or the operation.
3. Be strong enough to support the hand and forearm without losing its integrity.

4. Be firm but flexible.
5. Be lightweight and durable.
6. Be cost-effective.
7. Be available off the shelf.
8. Be easily modified according to the needs of the individual.

Position of comfort/position of function

Positioning of the hand in a splint is very important. There have been very few studies on this aspect. In most of these (Bateman, 1946; Bunnell, 1946; Capener, 1946) the emphasis has been on the status of the collateral ligaments of MP, PIP and DIP joints of the fingers. It is generally accepted that these joints should be placed in a position where the ligaments are in the taut position; i.e. that the MP joint is in 35° to 40° of flexion whereas the IP joints are almost in extension.

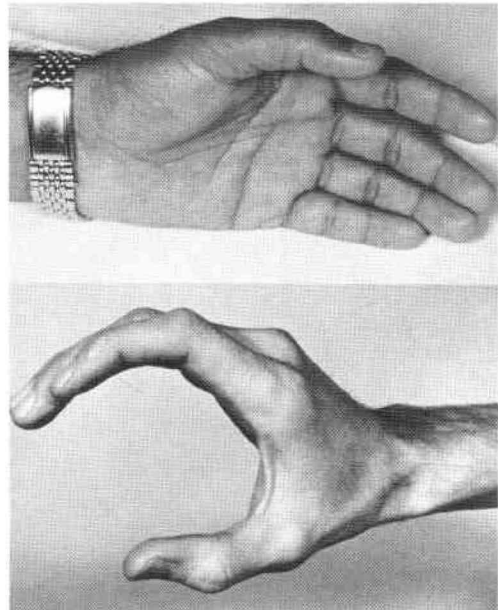


Fig. 1. Top, position of comfort/position at rest. Bottom, position of function.

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Observation of peoples' hands when they are walking, sleeping or at leisure shows a certain posture of wrist, hand and fingers—the attitude of comfort or rest (Fig. 1, top). This position is that of maximum relaxation with a corresponding decrease of energy consumption and increase in comfort. This position of physiological rest suggested by Capener closely resembles the prescribed position of function with the addition that the wrist is in slight dorsi-flexion with ulnar deviation and the thumb in opposition (Pryce, 1980) (Fig. 1, bottom).

The ideal splint, while maintaining this position, should also allow some movements within prescribed limits and approximately satisfy the criteria already listed.

High density Plastazote appeared to fit the material property criteria most closely being light weight, firm but flexible, durable, re-usable and inexpensive.

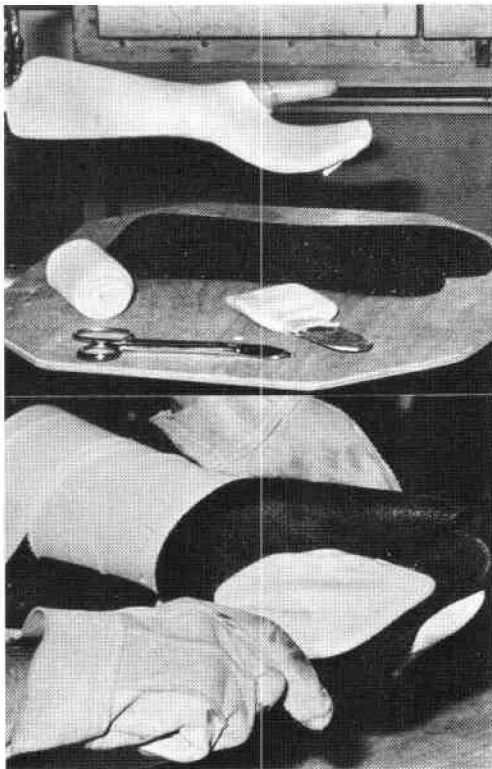


Fig. 2. Top, items required for splint fabrication—oven; pre-cut Plastazote sheet; spatula; crepe bandage; scissors; mounted cast. Bottom, use of spatula to contour the thenar eminence.

Fabrication of splint (Fig. 2, top)

A rough-shaped portion is cut from $\frac{1}{4}$ " high density Plastazote sheet, heated in an oven at 200°C for 3 minutes, and then wrapped on the master cast. (A pair of heat resistant gloves should be used to handle the material). A

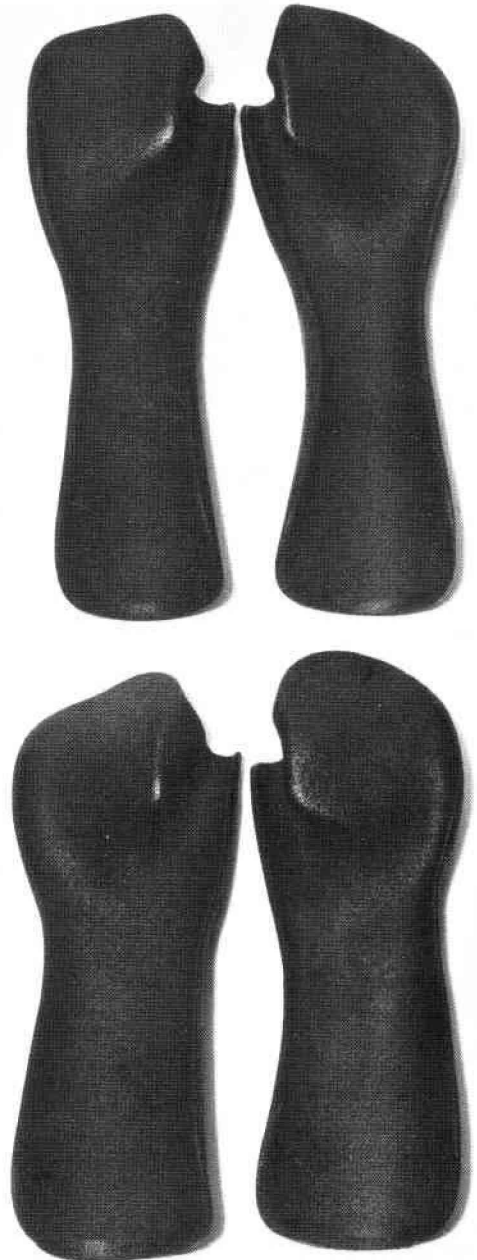


Fig. 3. Two sizes for each hand—large and small.

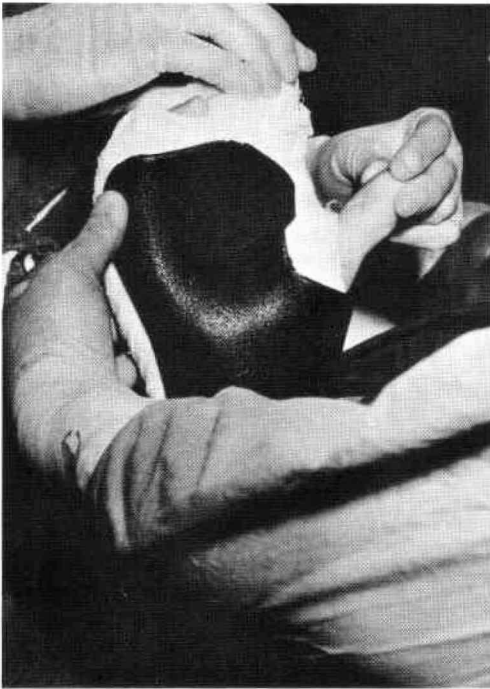


Fig. 4. Individually trimmed splint being applied.

spatula is used for contouring the thenar eminence (Fig. 2, bottom). A crepe bandage is used to wrap the splint round the master cast.

After proper pressure the bandage is removed. The final trimming of the splint is carried out simply by using bandage scissors.

Two standard sizes of splints for right and left hands are stocked and are then readily available, off the shelf (Fig. 3). The use of the splint in many patients with varying clinical conditions has suggested that two sizes meet the needs of most adult patients. This is due to the flexibility and malleability of the splint.

The larger size is sufficient to cater for all hands having bulky dressings i.e. post-operative patients and traumatic hands with bandages etc. The smaller size is used for splinting of hands where there is no bandage or minimal dressing. The contour of the splint can be adjusted by squeezing or stretching to fit the patient's forearm. Further individual trimming is easily performed at the time of application (Fig. 4).

Evaluation of splint

This splint has been evaluated on fifty hands (47 patients) following operation for Dupuytren's contracture. Forty-four were males

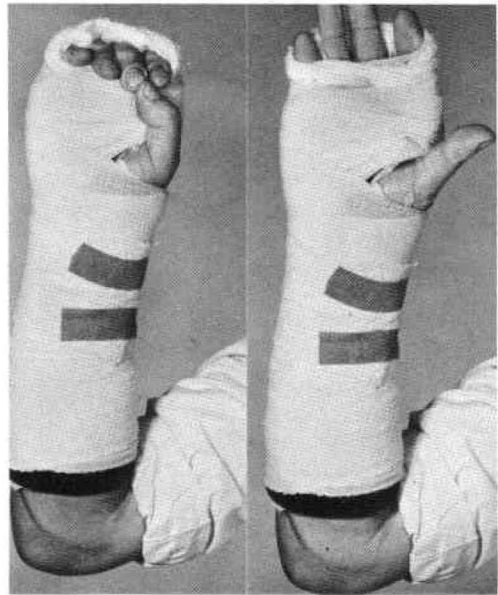


Fig. 5. Free movement of fingers and thumb with splint in position.

and only three were females. All the patients were operated on by open McCash technique and were splinted for two weeks.

At two weeks a subjective evaluation of the patients' impressions was carried out.

They were asked to comment on—

1. Pain—increase in pain after first day.
2. Movements of fingers and thumb (Fig. 5).
3. Weight of splint.
4. Acceptability of splint.
5. Any other comment.

None of the patients complained of any increase in pain after the day of operation. This was confirmed by the prescription of analgesics. All the patients required simple oral analgesics after twenty-four hours of surgery. All the patients but one were discharged home within forty-eight hours of surgery. Unfortunately one developed pneumothorax following brachial block regional anaesthesia. This was treated by chest drain, but he did not need any injectable analgesics. Most patients took a mild analgesic occasionally at home after discharge. All the patients were able to move the fingers and thumb freely and all agreed it was very light. None rejected the splint.

Six patients complained of the smell of the splint. It seemed that sweating and bleeding within the bandage caused an odour which was

unpleasant, but not serious enough to warrant rejection. This problem can easily be solved by using carbon impregnated dressings; carbon particles absorb odours.

At follow-up all the splints were examined for any breakage. Except for one or two creases in a few splints nothing abnormal was noted. All of the splints could be re-used twice with some being used three times.

Since the survey of patients operated on for Dupuytren's contracture the splint is also being used in the following conditions—

1. Post-operative patients following—
 - a—correction of flexion contracture of fingers.
 - b—repair of extensor tendons.
 - c—surgery for rheumatoid arthritis.
2. Infected hands.
3. Metacarpal fractures.
4. Neuro-muscular problems.

Discussion

Splintage is generally accepted as being necessary in the recovery of the hand following trauma, infection and operation, but positioning of the hand within the splint has always been a matter for discussion. The views of Capener, Bunnel and Bateman have been followed for years. Recently, biomechanical studies by Smidt et al (1975) and Pryce (1979) have confirmed that to gain maximum grip power the wrist should be placed in 30° of dorsiflexion with ulnar deviation. It is known that mobilization of the fingers with forceful grip will help in reducing swelling, thus relieving pain. This in turn helps

the patient to increase his active mobilization.

Reduction of swelling, relief of pain and active mobilization are the keys for the successful outcome for the hand under treatment.

Heavy density Plastazote is an excellent material. It has all the required characteristics, provides easy fabrication in the desired hand position and can be contoured according to the shape of the forearm. It has the added advantage of off the shelf fitting by trimming using simple bandage scissors.

REFERENCES

- BATEMAN, J. E. (1946). A universal splint for deformities of the hand. *J. Bone Joint Surg.* **28A**, 169–173.
- BUNNELL, S. (1946). Active splintage of the hand. *J. Bone Joint Surg.* **28A**, 732–735.
- CAPENER, N. (1946). Physiological rest with special reference to arthritis and nerve lesions and to the manufacture of appliances. *Brit. Med. J.* **2**, 761–766.
- PRYCE, J. C. (1979). The wrist position between neutral and ulnar deviation that facilitates the maximum power grip strength. *J. Biomech.* **13**, 505–511.
- RANK, B. K., WACKFIELD, A. R., HUESTON, J. T. (1973). *Surgery of repair as applied to hand injuries*. 4th ed. Edinburgh, London: Churchill Livingstone.
- SMIDT, G. L., FLATT, A. E., STEPHENS, R. I. (1975). The influence of wrist position on the force produced by finger flexors. *J. Biomech.* **8**, 301–306.
- WYNN PARRY, C. B. (1981). *Rehabilitation of the hand*. 4th ed. London: Butterworth.