POST OPERATIVE SPLINTS AND RETAINERS

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Introduction

Postoperative splints and retainers have a wide range of applications. At first blush one thinks of splints and retainers as useful for maintaining alignment that has been corrected surgically. And while that is an appropriate purpose it is only one function of a device. There are several others. Reduction of edema, control of scar tissue contracture, control of scar hypertrophy, enhancement of scar tissue softening, and relief of postoperative tenderness are additional uses.

Maintaining Alignment

Following forefoot surgery in which multiple toes are operated upon at the same interval it is important to maintain the toes on the same transverse plane during healing. It is quite easy for scar tissue contractures to result in one or more toes drawing out of alignment during maturation of the scar involved in tendon or capsular healing. An appropriately designed retainer can effectively guide and retain the alignment during such maturation period.

Reduction of Edema

Some types of splints and retainers are designed in such way as to provide firm and even compression. Such devices contribute to the control of stasis in the surgical area. The reduction of edema contributes to increased oxygen tension which is essential to the softening of scar tissue and return of soft tissue to the original supple consistency.

Control of Scar Hypertrophy

Control of hypertrophic scarring like the softening of scar tissue is an oxygen dependent process. By designing a retainer to provide constant pressure to the surgical area it is possible to greatly limit the development of scarring and keloids. Polyurethane molds, appropriately sculptured and molded, can provide both retention and the constant pressure that is essential to the control of edema and the promotion of supple scar maturation.

Relief of Tenderness

Postoperative deep tenderness is a manifestation of congestion in the operative part and is largely a product of inflammation which accompanies the body's response to surgical trauma. By employing splints, bandages, or retainers that contribute to the reduction of edema in the part such deep soreness is reduced or eliminated. Polyurethane retainers in the forefoot and elastic bracing of the rearfoot and ankle can significantly expedite the elimination of post surgical stasis which is responsible for the deep tenderness that delays return to normal function.

Latex and Felt Digital Retainers

One of the simplest postoperative digital retainers is constructed of wool and cotton felt, tubegauze, moleskin, elastoplast tape, and ammonia based liquid latex. Such retainers are prepared in a matter of minutes and can be quite durable. They are quite effective in retaining alignment of the lesser toes and provide some buttress against lateral drift of the hallux where it has undergone surgery at the same interval as the toes.

These retainers have an added advantage of taking up only minimal space in the patient's shoes. It should be pointed out, however, that this type device may actually increase edema in the tips of the toes while decreasing swelling in the area it actually encompasses. Such devices are inadequate for milking edema from the slightly more proximal metatarsophalangeal joint areas.

Materials

#1 tubegauze
3/16 inch felt (75% wool, 25% cotton)
1/8 inch adhesive felt
2 x 2 inch moleskin squares
Elastic tape
Skin adherent
Ammonia based latex rubber
Catalyst (1 part white vinegar, 1 part water) in a spray bottle
Talcum powder

Technique Latex/felt/tubeqauze Retainer

The technique of preparation of the latex/felt/tubeqauze retainer is illustrated in the following:

1. A felt ram is cut to completely occupy the sulcus from the pulp of the toes to the distal end of the

ball of the foot. The ram should be wide enough to extend from the medial margin of the second toe to the lateral plantar margin of the fourth toe. The ram should fill the sulcus but should not be

Fig. 1

designed to raise the toes. It should be skived with a scissor to contour proximally and distally to the toes. By filling the sulcus it should serve as a barrier against contracture of the toes (Fig 1.).

2. Skin adherent is painted on the toes dorsally and plantarly just at the points where the retainer is to contact the skin. This helps to anchor the re-

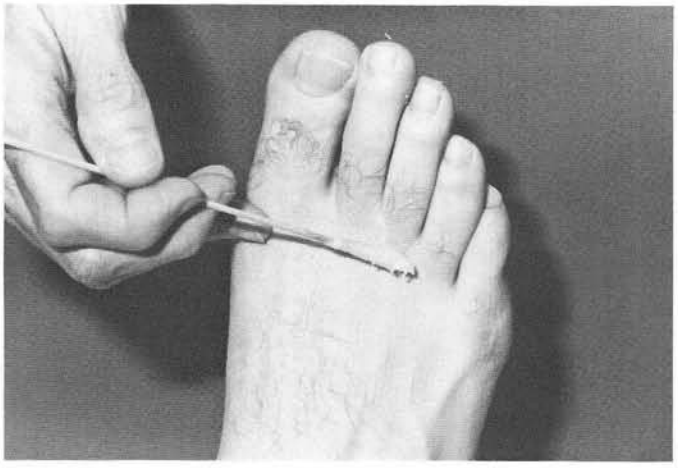


Fig. 2

tainer during the initial setting of the device to the contour of the foot (Fig. 2).

3. A piece of #1 tubegauze approximately 10 inches in length is cut (Fig. 3).

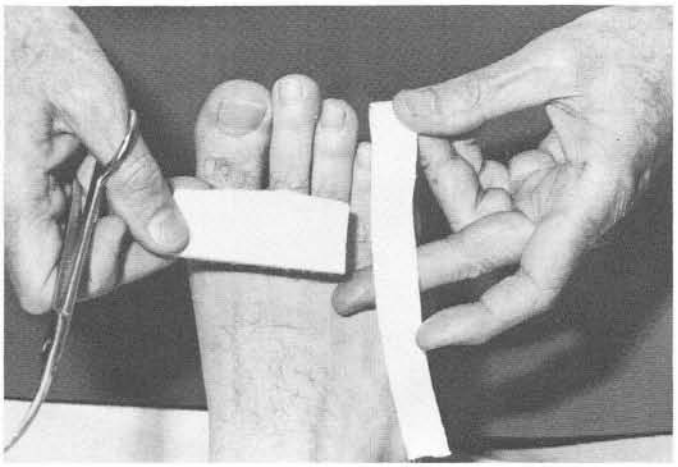


Fig. 3

4. A hemostat is thrust through the tubegauze, and the ram is grasped and drawn into the center of the tubegauze length (Fig. 4).

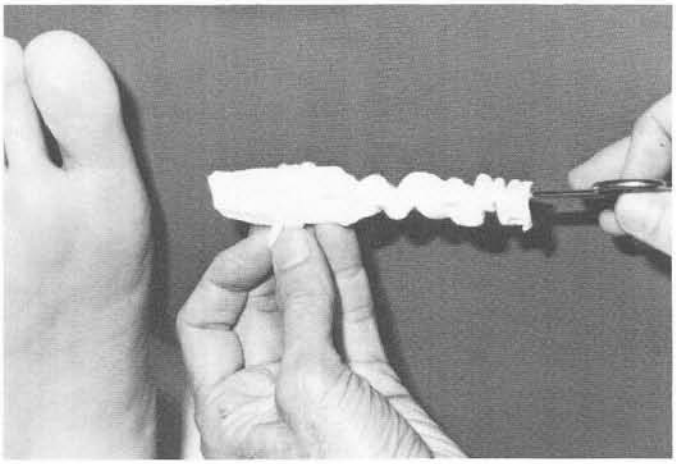


Fig. 4

5. The ram is laid in the sulcus and the ends of the tubegauze are brought up through the first and fourth digital spaces to the top of the toes. The ends lie loosely for the time being (Fig. 5).

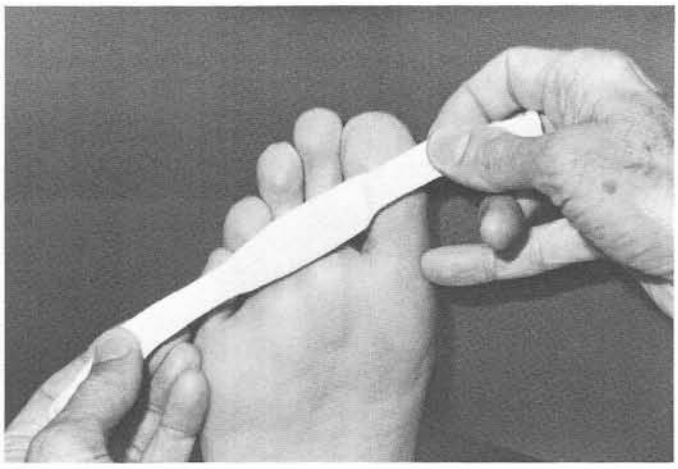


Fig. 5

6. A 2x2 inch square of moleskin is laid adhesive side up over the intermediate three toes. The moleskin is trimmed to the width of the three toes. It is then laid in place where the skin adherent helps to hold it (Fig. 6).

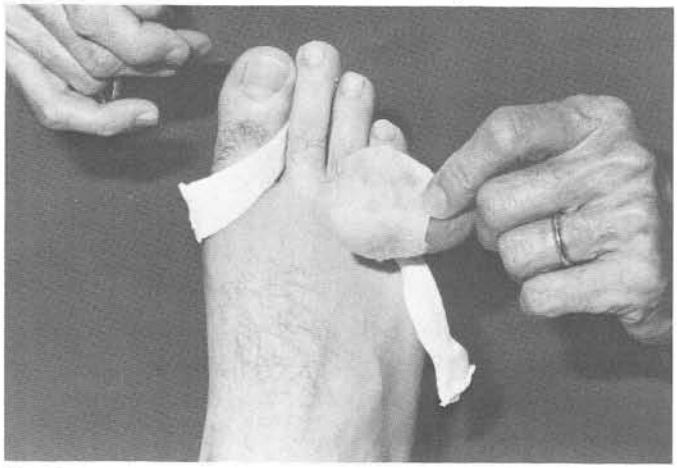


Fig. 6

7. The tubegauze ends are trimmed of excess and folded snugly down across the the adhesive side of the moleskin (Fig. 7).

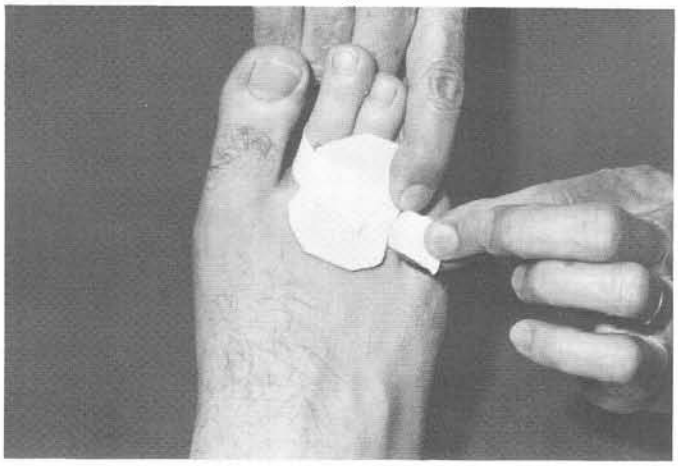


Fig. 7

8. Additional dorsal ram can be added by one or more layers of adhesive felt laid across the dorsum of the three middle toes. If hallux ram is needed to support the position of the great toe the dorsal ram may also extend medially around the second toe (Fig. 8).

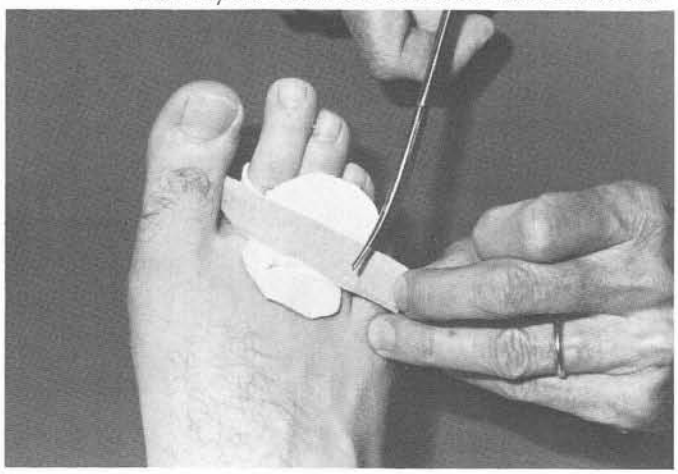


Fig. 8

9. The device is reinforced with an encircling layer of ½ inch wide elastic tape (Fig. 9).

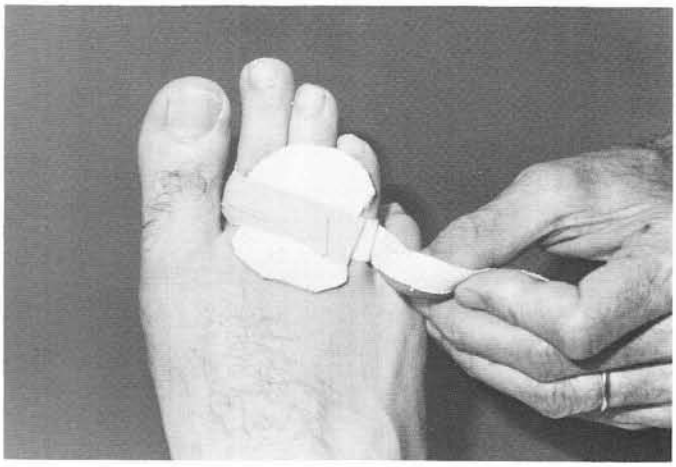
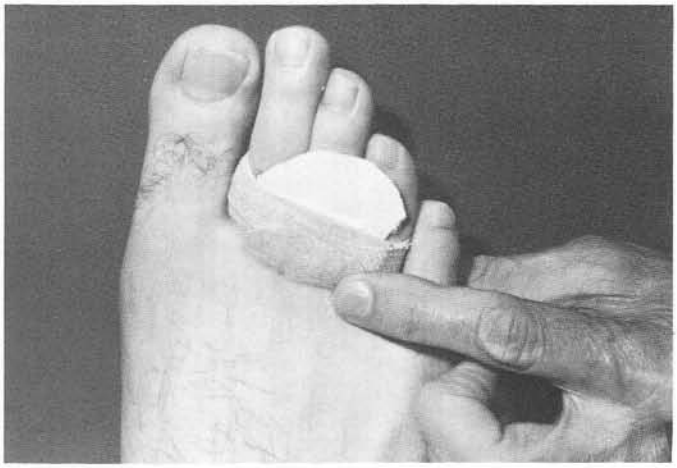


Fig. 9

10. The moleskin square is folded over the tubegauze. The proximal edge of the moleskin is folded forward followed by folding the distal edge proximally. This sequence is important in avoiding rolling of the edges when stockings are pulled over the device (Fig. 10).

A



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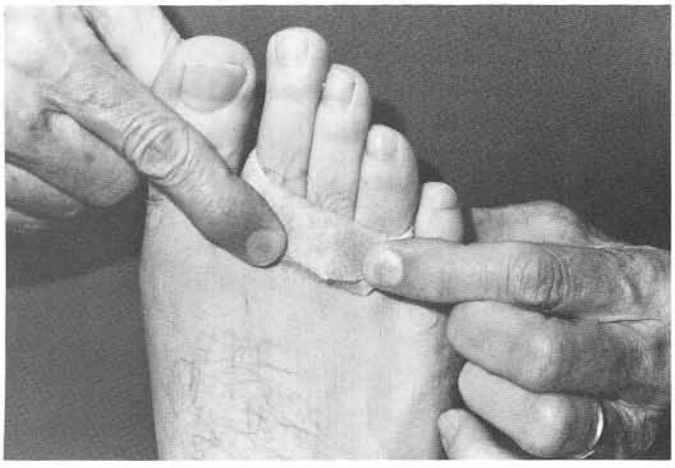


Fig. 10

11. The device is then painted around its entire outer surface with ammonia based liquid latex. The inner surface of the device with is in tight contact with the toes is not latexed (Fig. 11 A & B).

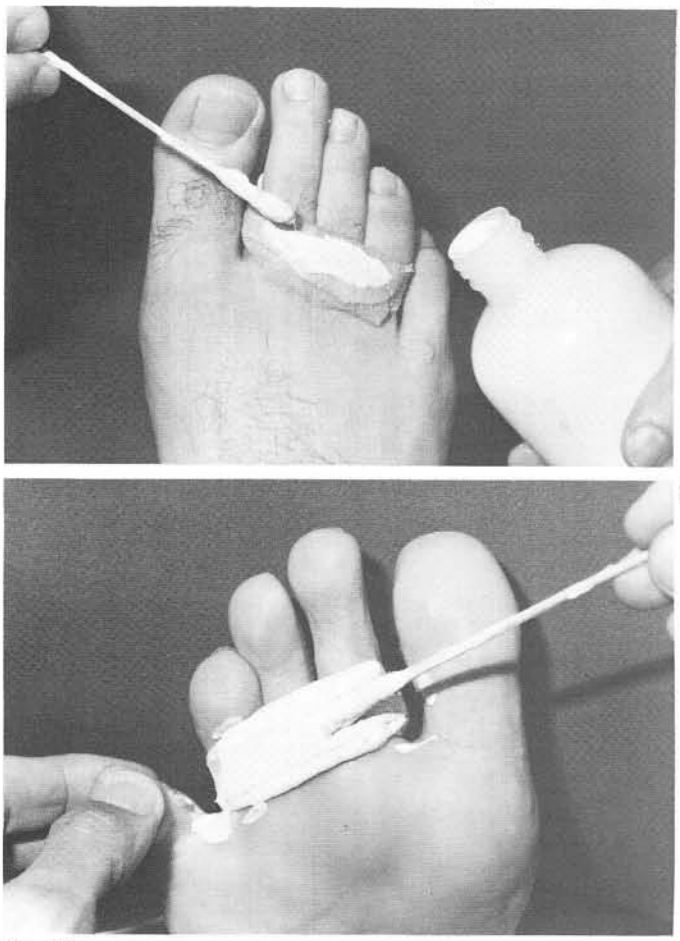


Fig. 11

12. The latexed device is sprayed with catalyst to harden the latex (Fig. 12).

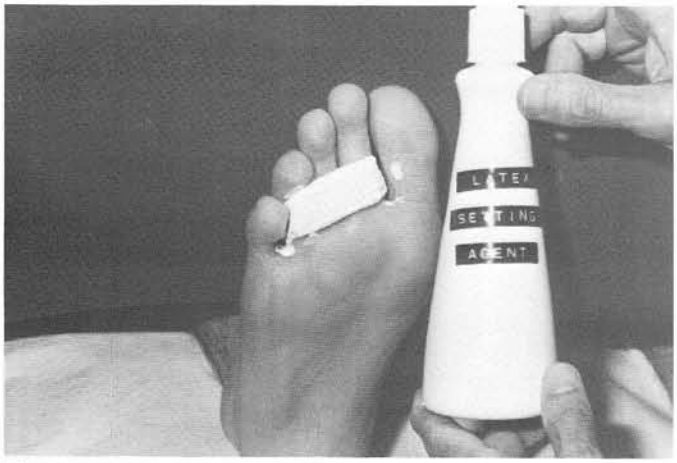


Fig. 12

13. A second layer of latex is added. The cotton tipped applicator must be kept quite wet when applying the second layer. Otherwise the applicator may become adherent to the catalyst coated layer below.
14. A second coat of catalyst is sprayed on the device.
15. The device is blotted with an absorbent paper towel.
16. Talcum is patted onto the surface of the device and stockings are placed on the foot.
17. The device is removable anytime after three hours. Because of the latex application the device is quite durable and will hold its shape well (Fig. 13).

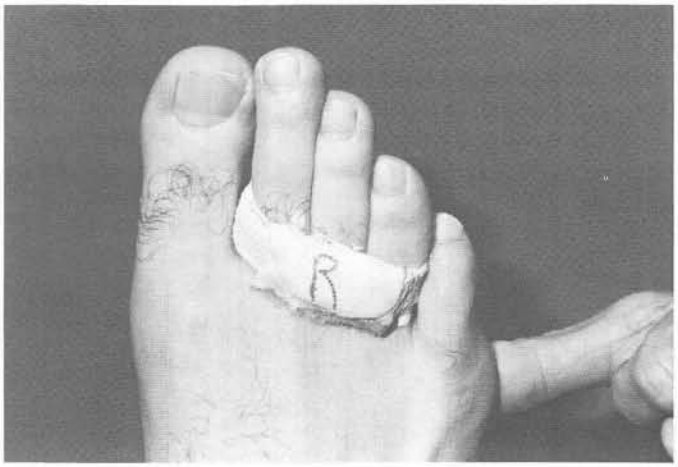


Fig. 13

Discussion

The latex/felt/tubeqauze retainer is durable and comfortable to the patient. It is worn effectively in many shoes that will not accommodate bulkier types of retainers. It is easy and rapid in application, requiring less than five minutes to completely prepare. It can be prepared before the patient has returned to closed foot gear, making it useful even in the open surgical shoe. It can be worn both day and night with a sock being worn over the foot for nighttime wear. The device is not effective in milking edema from the metatarsophalangeal joint area and must be combined with an elastic sleeve if such edema is a consideration.

Polyurethane Retainers

Polyurethane retainers are molded from polyurethane foam which has been appropriately structured and subsequently impregnated with vultex, a non-ammonia type latex. The excess latex is blotted from the device before it is applied to the foot. The device is covered with plastic baggies and a sock and shoe applied and kept in place for a minimum of 5-6 hours before removal.

It is important to realize that a polyurethane mold cannot be made without an appropriate shoe. This means that the patient must have returned to a closed shoe before attempting to prepare a molded retainer. The shoe must be of a closed variety and must not be overly tight. It is also imperative that the clinician appropriately shape the device before attempting to mold it.

Advantages of the molded urethane retainer include a very profound effect on post surgical edema and the resultant effect of softening and minimizing of scar tissue. To the authors knowledge there is no more effective system for milking edema from the forefoot following multiple procedure forefoot surgery. The device, once completed and sealed, is washable and reasonably durable. With a properly stocked urethane kit the devices are made rather quickly, 3-5 minutes of doctor's time and 5 minutes of assistant's time.

Urethane devices can be worn day and night but in all candor lose many of their advantages when worn without a shoe. Consequently, they are generally recommended for daytime wear when the patient can maintain the foot in a closed shoe.

Materials

Vultex (vultex 3-e-709)
General Latex and Chemical Co
Ashland, Ohio
l-419 289-2727

or

Cucamonga, California
1-714-987-6261

Urethane Foam (Serafoam 1 in. and 2 in. thick)
Sears, Roebuck and Co.
Upholstery products
See Sears Catalogue

Punches (available as a set)
Will Scientific Co.
P.O. box 529
243 Broadway Street
Cambridge, Mass.
(#9956 punches, #9986 sharpener for punches)

Insta-Seal Kote (for sealing outer surface of finished mold)
Insta-mold prosthetics, Inc.
430 N. Sixth Street
Philadelphia, Pa. 19123
1-215-627-5004

Cleartape
Johnson and Johnson
Supply houses

Baggies
Small and large
Grocery stores

Plastic Disposable Gloves
Medical Supply Houses

Printed Instructions

Salt Shaker filled with plaster of paris
(catalyst when making additions)

Compression Template
(square of 3 mm Rohadur with 1 in. diameter hole cut in center for compressing urethane while punching)

Instructions for Urethane Molds

Urethane molds are specially constructed appliances generally designed to provide a corrective or a retainer function upon the toes.

Urethane molds are constructed of polyurethane foam and a special plastic latex solution. Molds are placed on the foot wet and after having dried (approximately 6 hr.) form a removable appliance which may be removed from the foot at night and reapplied each morning. When being worn as postsurgical retainers, they may be worn night and day, with removal only for bathing.

Care of the Mold

First Day Care

1. The urethane appliance is wet and has been covered with a protective bag to protect your foot-gear.
2. The protective plastic bag should be removed in 6-8 hr. or at bedtime.
3. The appliances are then firm but slightly moist. They should be allowed to dry overnight, then carefully replaced on the toes and worn daily until your next visit. When being worn as postoperative retainers, the mold may be worn at night also, covered with a sock.
4. In the event the urethane mold is not completely comfortable, remove the mold, and bring it with you on your next scheduled appointment. It is unfinished in its present form and will be adjusted and corrected on your subsequent visits. Postoperative retainers should be removed only where quite uncomfortable, and in such event, an appointment the following day should be arranged at the office.

Care at Home

1. Wash the molds several times weekly. They may be washed by sponging off with a mild detergent and water solution.
2. Your urethane mold will have been completed by your second or third office visit. You may then talcum the mold with plain talcum or baby powder, both inside and outside, each day before applying the mold on the foot.
3. When coming to the office for a checkup and adjustment of the urethane mold after it has been completed, it is best to wash the appliance, but do not apply powder prior to the visit. Adjustment of the correction on the urethane mold is more readily accomplished when no talcum is present on its surface and when it has been thoroughly cleaned.
4. In the event the mold breaks or shows wear, phone the office for an appointment so that we may make the necessary repairs or replacement.

Fig. 14 Urethane retainer instruction sheet for patients

Technique, Hallux Compression Jacket/Retainer

The step by step technique for preparing polyurethane retainers is demonstrated in the following:

1. Cut appropriate size piece of 2 inch thick urethane. Be sure the piece is long enough to allow for an ample dorsal and plantar flap as needed (Fig. 15).

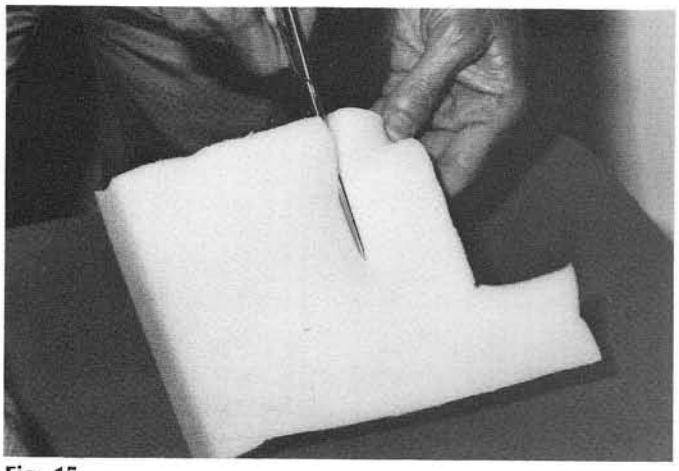


Fig. 15

2. Punch hole for hallux. For punching select the punch slightly larger than the hallux. If no punch is large enough then punch one hole and then a second eccentricly located hole to provide adequate passage for the hallux. Compress the urethane on a wood or cork block while punching. A Rohadur template with a central opening is of great assistance in compressing the urethane foam to facilitate punching (Figs. 16 A & B).

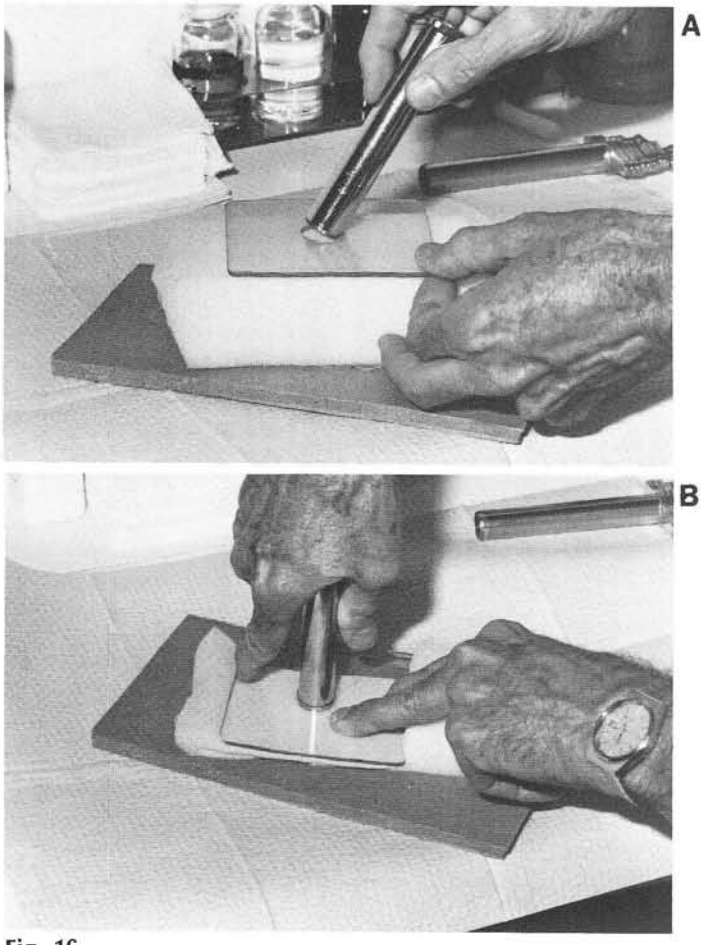


Fig. 16

3. Flaps are next structured using a long blade scissor to make incomplete cuts adjacent to the punched hole. Additional cuts are made to hemisection the flaps and decrease them to the desired thickness (Figs. 17 A & B).

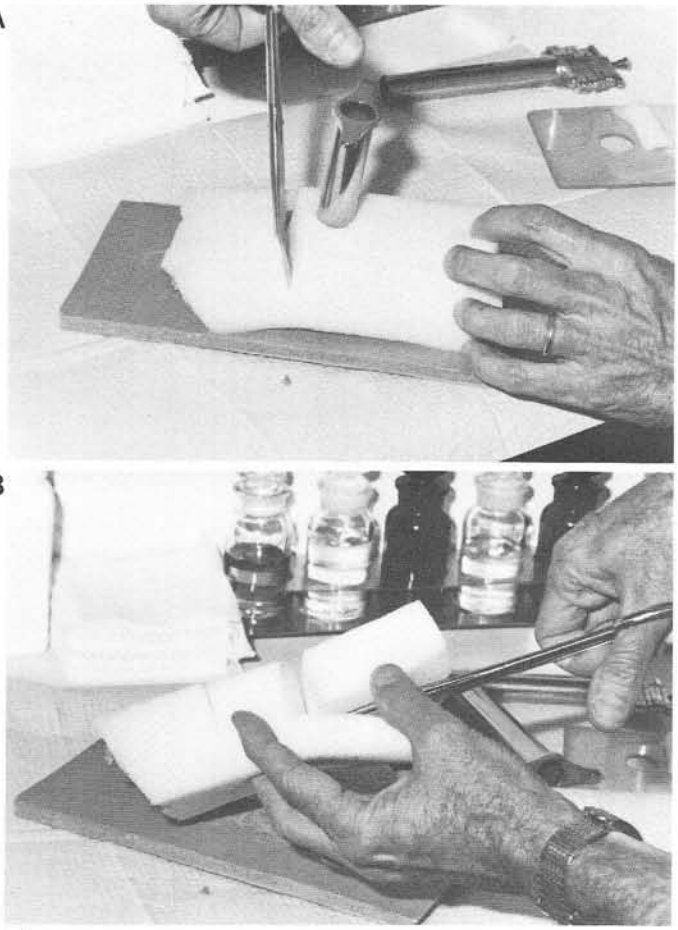


Fig. 17

4. A scoop out of material along the lateral side of the hallux assists in fitting to the second toe and also helps to resist rotation of the device.
5. The device is placed on the hallux and the flaps folded dorsally and plantarly. The scissor is used to thin the device where little pressure is needed and is allowed to remain thick where considerable ram effect is needed (Figs. 18 A, B, C).
6. The device is then passed to the podiatry assistant for processing and molding.
7. The urethane device is placed in a large baggie.

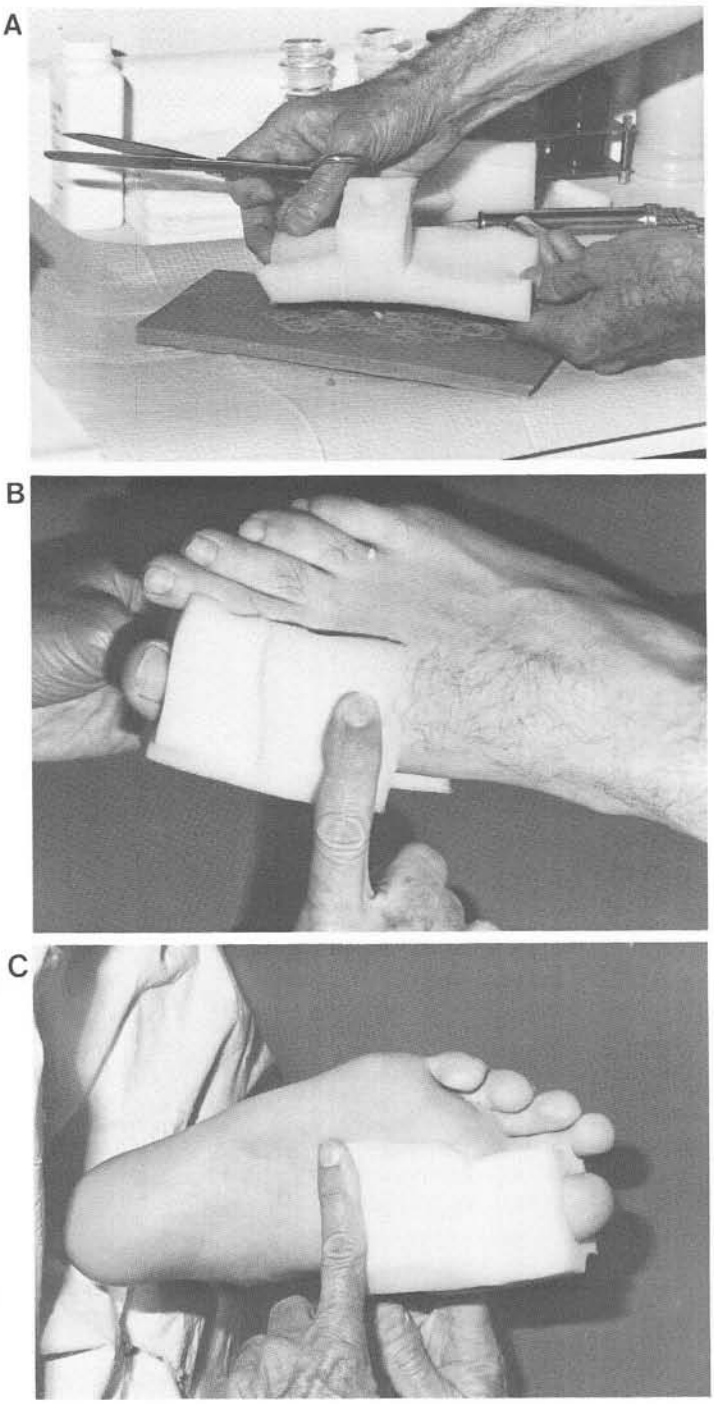


Fig. 18

8. Vultex (3-e-709) is poured into the baggie with the device sufficient to impregnate it. The mouth of the baggie is held lightly closed while the other hand massages the device to thoroughly impregnate it with the liquid (Fig. 19).

Fig. 19

9. Disposable vinyl gloves are donned and the device is lifted from the bag and blotted of excess vultex. Blotting the device lightly will result in retention of more vultex and a firmer device will result. Thorough blotting will result in retention of lesser vultex and a softer device will be produced.
10. The device is placed on the hallux and the flaps folded into place (Fig. 20).

Fig. 20

11. A small baggie covers the device and the forefoot and is taped in place with plastic cleartape. The palms are used to express air from the device and from the baggie (Fig. 21).

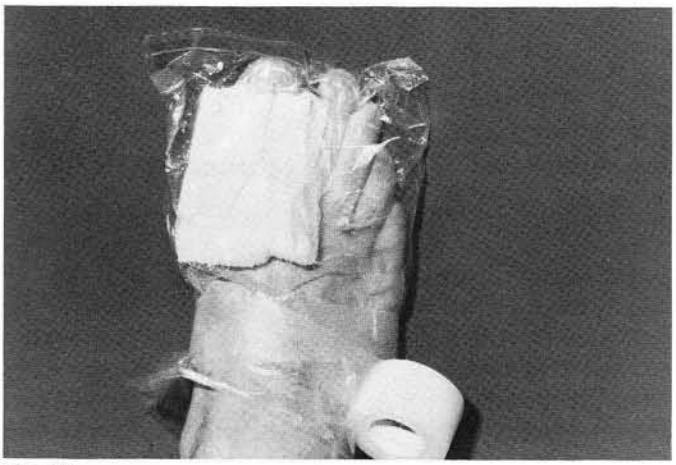


Fig. 21

12. A second large baggie is placed over the foot and ankle and is taped above the ankle with cleartape after expression of excess air. This second baggie is necessary in case the fluid should be expressed or ruptured from the smaller bag.
13. Stockings or socks should be placed over the bagged foot. A third large baggie is placed over the stocking to serve as a skid for sliding the foot into the shoe (Fig. 22).

Fig. 22

14. The shoe is tied and the patient is allowed to begin standing and walking.
15. Thirty minutes later the outer baggie is removed, the toe of the stocking is straightened and the foot replaced in the shoe.
16. Shoes are kept on until bedtime or a minimum of 5 hours before removing the shoe, the baggies, and the slightly moist device.
17. Congealed vultex is easily peeled from the skin after the device is removed.
18. The device is set on a paper towel to dry overnight. It is replaced on the hallux, covered with a clean sock, and worn to the office the next day or as soon as practical for sealing.
19. The device is checked and adjusted. If additions are needed the device is replaced in a baggie and reimpregnated with latex. The urethane to be added is also impregnated with latex. Both are blotted. Plaster of paris powder is next sprinkled on the area of the device to which the addition is to be made. The addition is touched to the the plaster which serves as a catalyst to set the surfaces. The device is recovered with baggies and the foot replaced in the shoe for remolding. The device is again worn for a minimum of 5 hours to allow thorough molding. Rarely is such remolding required.
20. With satisfactory molding completed sealing of the mold is done to add strength, durability, and to facilitate proper hygienic care of the device.
21. The device is painted with two or three coats of InstaSeal-Kote, a silicone coating that provides a protective barrier. After each coat the device should be placed under an air blower for 5-7 minutes of drying. Note: once the device is sealed with the silicone sealant there can be no further additions (Fig. 23).

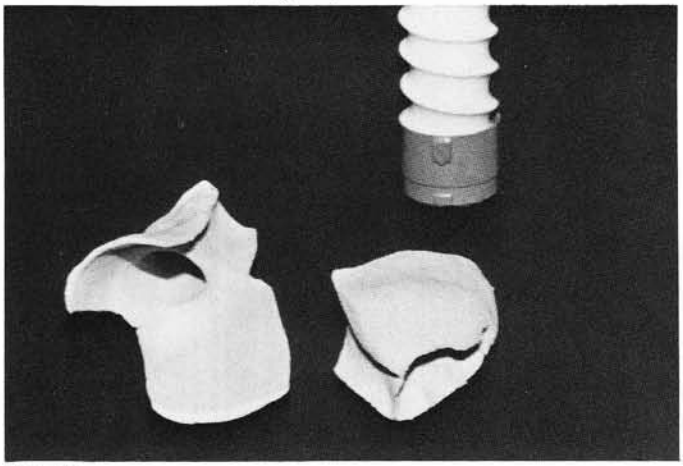


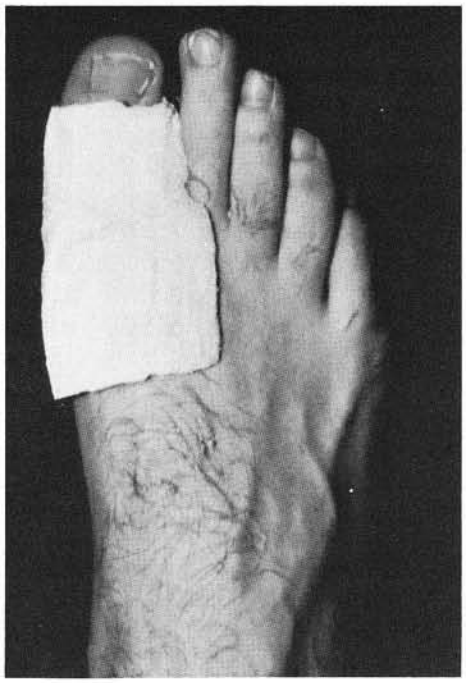
Fig. 23

22. Talcum should be applied to the device lightly and rubbed in each morning before donning the retainer (Figs. 24 A & B).

Discussion

It should be apparent that the molding of the urethane is dependent on the compression supplied by the shoe against the device. It is impractical in most cases to attempt to make any type of molded polyurethane retainer until the patient can return to a closed oxford type shoe. Most any type of oxford such as jogging shoes will suffice.

A



B

Fig. 24

The molded hallux compression jacket/retainer is quite effective in milking edema from the foot and in minimizing scar tissue hypertrophy. The device can encourage the rapid return of range of motion to the joint after surgery and can greatly ease the deep tenderness that is present for a time following surgery.

Wearing of the device in a slightly smaller or dressier shoe than that in which it is molded can be planned. After premolding for a period of three hours the device is rather compressed. The patient can then change to a less spacious shoe for an additional two hours of molding. Once the device is molded so as to compress into the smaller shoe it can be worn equally well in either shoe. On the other hand, the device that is only molded in the loose shoe can only be worn in that shoe since it would be too tight for the less spacious type.

Technique/Slit Crest

The slit crest is probably the most versatile and certainly the easiest type polyurethane retainer. Its construction is demonstrated forthwith:

1. A block of 2 inch thick polyurethane is selected (Fig. 25).

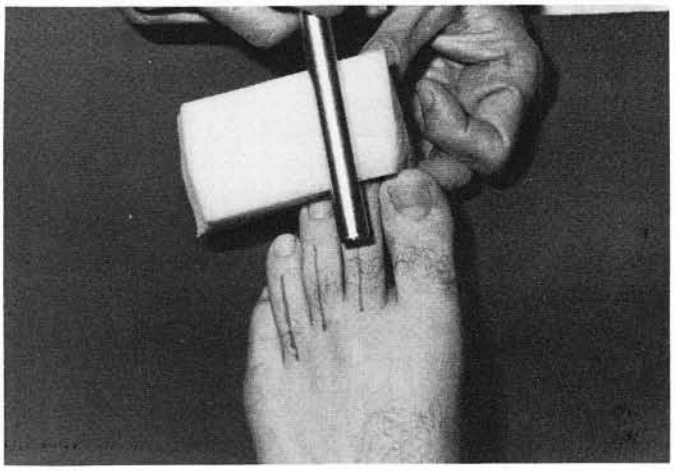


Fig. 25

2. Utilizing a medium sized punch, holes are prepared for the second and fourth toes (Fig. 26).

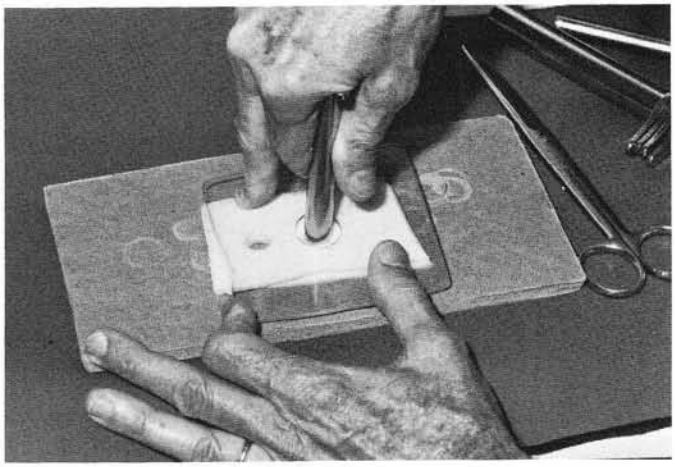


Fig. 26

3. A long blade scissor is used to slit the section between the two holes — thus the name slit crest (Fig. 27).
4. The area adjacent to the hallux and the area under the fourth toe are sculptured to appropriate thickness. The area beneath the fourth toe must not be too thick since the web is rather shallow at that point.

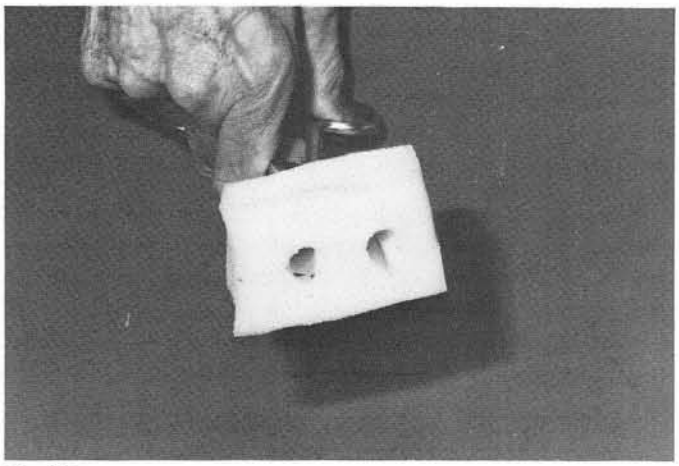


Fig. 27

5. The slit crest is slipped around the three middle toes much like a bracelet. The retainer is then shaped with the long blade scissor to contour to the toes and to provide as much dorsal compression as is deemed needed over the metatarsophalangeal joints and over the toes (Figs. 28 A & B).

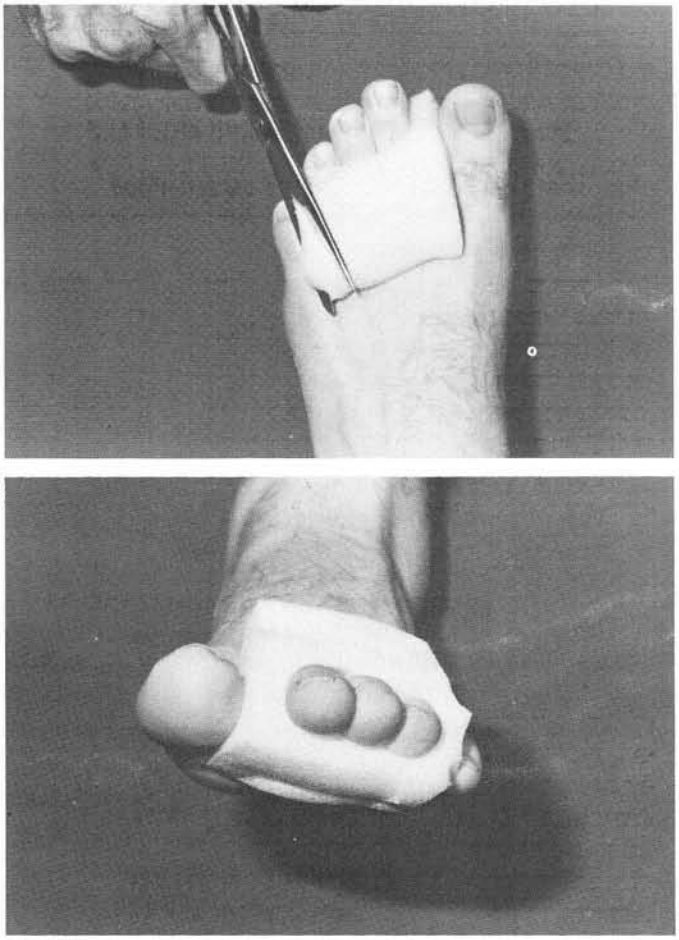


Fig. 28

6. The sculptured slit crest is then handed to an assistant to be processed.

7. The retainer is placed in a baggie and impregnated with vultex. It is blotted and slipped around the three middle toes, covered with one small and one large baggie and the foot placed in stockings and shoes (Figs. 29 A-D).

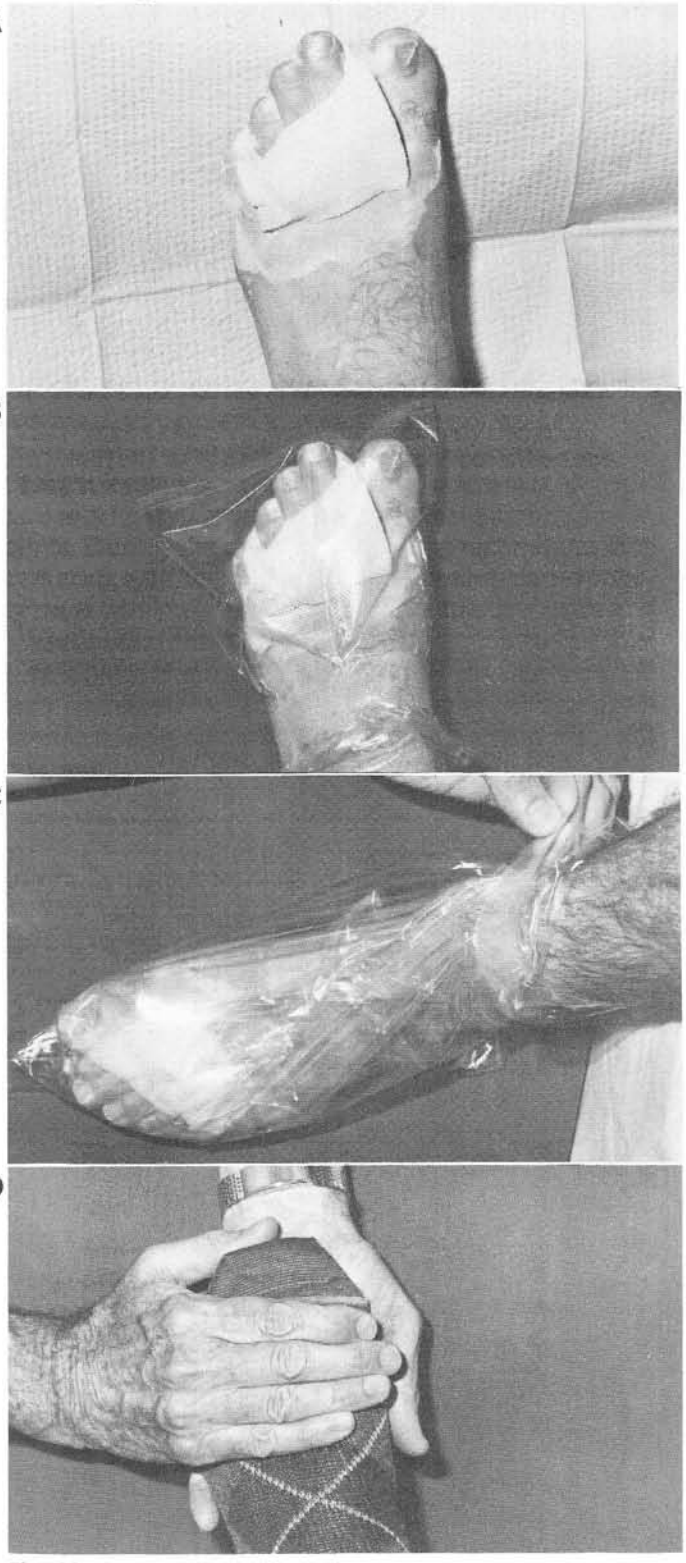


Fig. 29

8. The adjustment and sealing of the retainer is the same as described for the hallux compression jacket above. If any point of irritation or excess pressure is present it may be adjusted with a carborundum drum and drill or with a scissor before sealing with Insta-seal-kote (Figs. 30 A-C).

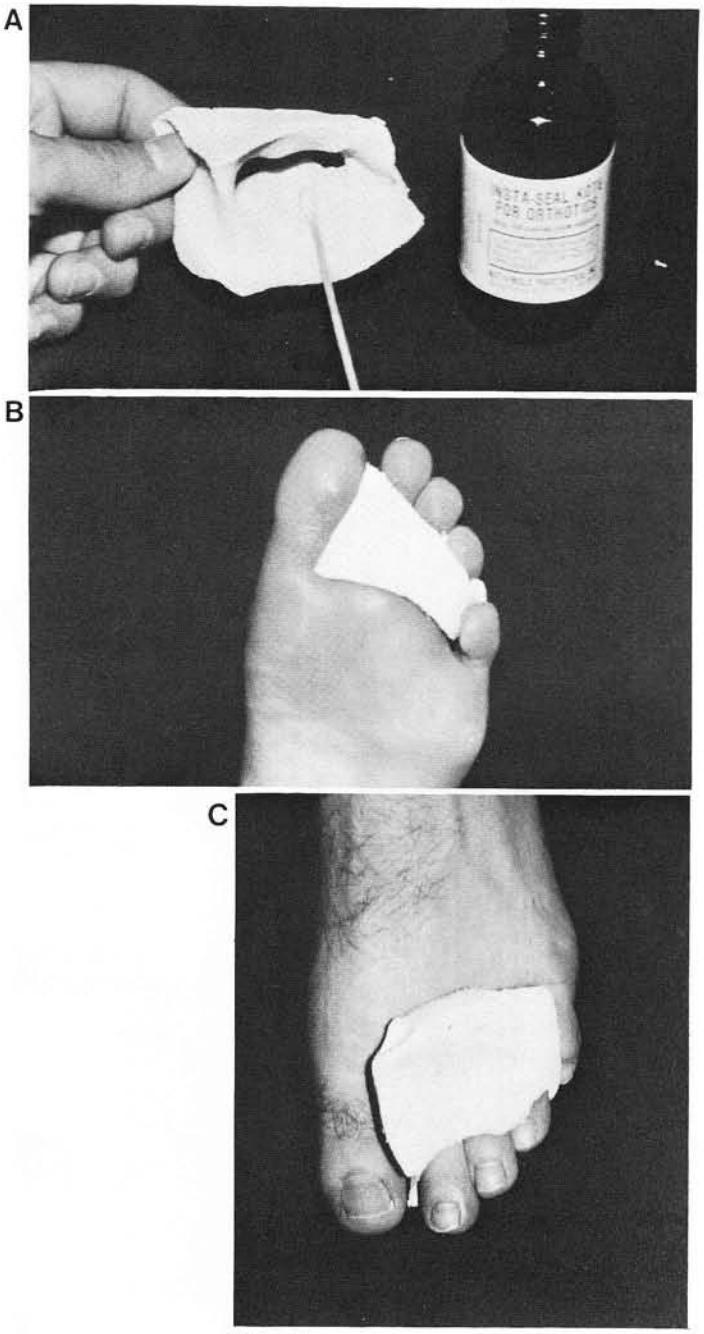


Fig. 30

Discussion

The slit crest is probably the most versatile of all post-operative urethane retainers. A modification of the slit crest incorporates the fifth toe in addition to the three intermediate toes and is appropriately referred to as a slit crest + 5. When this modification is used the urethane must not be allowed to retain any substantial thickness over the fifth toe.

When the slit crest + 5 is utilized it is often prudent to remove the post between the fourth and fifth toes as soon as the device has set. The post is useful in helping to maintain position while the device is molding and insures a better fitting. But after the device has set the post may be a serious barrier to applying to and removal from the toes.

The slit crest or its modifications are especially useful in milking edema from the lesser metatarsophalangeal joints and from the lesser toes. By using 2 inch thick urethane one is able to provide incorporation of almost the full length of the toes. This assists in compression of the toes without the tendency to trap edema in the distal aspect of the digit.

The slit crest retainer is often helpful for three months or more following multiple digit or multiple metatarsal surgeries.

Lesser metatarsophalangeal compression jacket

Lesser metatarsophalangeal joint compression jackets are constructed much like the hallux jacket. Both dorsal and plantar flaps are possible and are varied in thickness and shape depending on the areas one wishes to support or compress. In addition a toe/metatarsophalangeal joint can be supported in the transverse plane and edema expressed from both joints.

Technique

1. Select a block of urethane from two inch stock.
2. Punch a hole for the involved toe using a punch just larger than the toe.
3. Using the long blade scissor make two cuts parallel to the punched hole. Then make two cuts perpendicular to the two initial cuts, thus hemisectioning the block. This creates two flaps. The thickness of the flaps is determined by the placement of these two hemisection cuts.
4. Sculpture the urethane medially and laterally to the hole to provide for comfortable fitting against the adjacent toes.
5. Slide the device over the involved toe and fold the flaps dorsally and plantarly over the metatarsophalangeal joints. Trim the device to fit to the contours of the toes and the metatarsophalangeal joints. Additional thickness is retained in those areas where compression is needed.
6. The sculptured retainer is handed to the assistant for vultex impregnation and molding.
7. The device is completed as described for the foregoing retainers.

Non Molded Urethane Retainer

Small blocks of urethane are tolerated well as support for individual toes. Possibly the most frequent need for such

support involves the hallux following first metatarsophalangeal joint surgery. The urethane is shaped to appropriate size and contour with a scissor. By being properly contoured it fits securely between the toes with no tendency to dislodge.

Technique/Carved Hallux Wedge

1. Select a small block of urethane (Fig. 31).

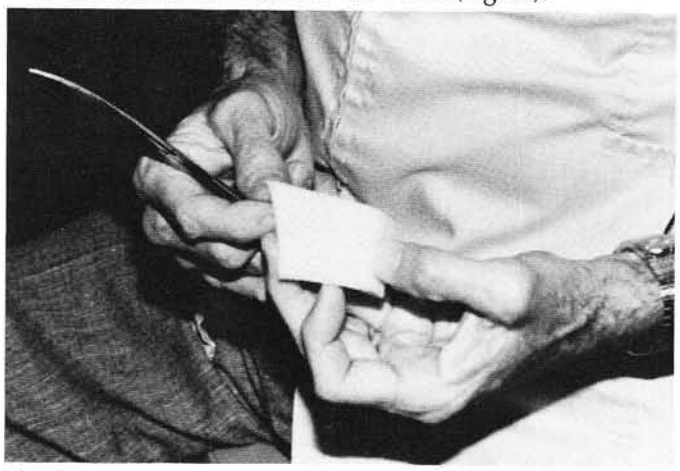


Fig. 31

2. Cut the wedge appropriate in length to the hallux and second toe.
3. Lay the wedge longitudinally against the middle finger. Bend the urethane backwards over the third finger and pinch with the second and fourth fingers to lock the material temporarily.
4. Using a straight scissor sculpture from the full length of the palmar side of the device (Fig. 32).

Fig. 32

5. Release the hold of the two adjacent fingers. As the device straightens the sculptured surface assumes a contour similar to the that of the finger over which it was sculptured (Fig. 33).

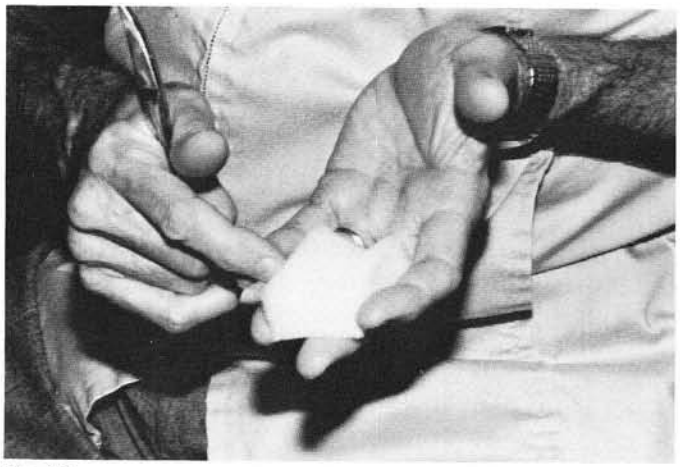


Fig. 33

6. Place the wedge between the hallux and second toe with the skived side facing the hallux. Check for adequate thickness and length (Fig. 34).

Fig. 34

7. No molding is necessary and the device is held in place by the contour and the stockings. The device can be worn day and night and is completely washable.

Elastic Devices

Elastic devices have broad application in both forefoot and rearfoot. Such devices can be as simple as an appropriately wrapped elastic bandage or tubular elastic support or an elastic stocking. More commonly a more precise form of elastic support may be needed to facilitate reduction in edema and early return to function.

Malleotrain Ankle Brace

Available from:

Bauerfiend USA
811 D Livingston Ct.
Marietta, Ga. 30067
404 691-7666

The malleotrain ankle brace is a well fitted elastic rearfoot and ankle support. It is woven elastic with a sorbothane type filler in the retromalleolar and anterior ankle area. The devices must be fitted as lefts or rights. They are quite effective following removal of casts and return to shoes after rearfoot/ankle surgery (Fig. 35).

Fig. 35

The device is often continued for a number of months after return to foot gear and is a major contributor to dissipation of edema and induration in the rearfoot. One word of caution, the device is only effective if fitted properly.

While intended for use following injury or surgery it is interesting to note the rather wide application of the device as an adjunct in the treatment of heel pain and in the management of severe arch strain.

Elastic Metatarsal Strap

Available from:

Chicago Medical Equipment Co.
300 Wainwright Dr.
Northbrook, Illinois 60062

The elastic metatarsal strap can be most useful following multiple surgeries of the metatarsophalangeal joints and toes. It is often used in conjunction with the latex/felt/tube-gauze retainer. Its greatest use is in treating edema largely confined to the metatarsophalangeal joint area. It needs to be fitted well but is not tolerated if excessively tight (Fig. 34).

Celastic Splinting (Cellulose Acetate Impregnated Cloth)

Available from:

Chicago Medical Equipment Co.
Northbrook, Illinois 60062

Celastic is a cloth impregnated with cellulose acetate. It is available in varying thicknesses from podiatry supply houses. For purposes of splinting toes or metatarsophalangeal joints the #125 thickness is recommended (Fig. 36).

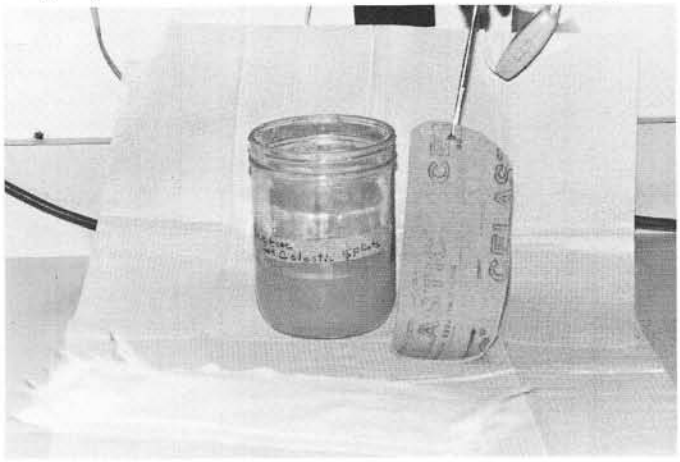


Fig. 36

The cloth is activated by dipping it in a small amount of acetone. It is best to handle the dipping by holding the shaped piece of celastic with a hemostat. After activating avoid touching the celastic with the fingers since cellulose acetate can only be removed from the skin with more acetone.

Activated celastic strips are laid out on cast padding or webril. A second layer of cast padding is applied to the top side. The material can then be handled without having it stick to the fingers. It can likewise be trimmed or shaped further with scissors. There is then ample time to apply to the foot any time in the next 30 minutes since setting of the splinting material is somewhat slow (Fig. 37).

Fig. 37

Splinting of First Metatarsophalangeal Joint

1. Cut 1 and 1/2 inch wide by 6 inch strip of celastic.
2. Shape to approximate size desired to mold plantarly and somewhat medially around the first metatarsophalangeal joint.
3. Activate celastic by holding with hemostat and dipping in small amount of acetone.
4. Lay activated splint on layer of webril. Place second layer of webril on top of splint.
5. Next complete the normal bandaging of the foot including the first metatarsophalangeal joint.
6. Lay the activated splint with its webril covering along the plantar and plantar medial aspect of the hallux and first ray.
7. Bandage in place with 2 inch kling bandage being sure to overlap each turn of the bandage with the previous turn. This maneuver assists in molding the splinting evenly without wrinkles.
8. Several hours are allowed for curing before the splint becomes completely rigid.
9. Where additional rigidity is desired more than one layer of celastic is placed one on top of the other before applying the top layer of webril and bandaging in place.

Discussion

Celastic splinting of the first metatarsophalangeal joint is useful in those instances where movement of the joint is undesirable. Typically the appropriately thick splint molded to the foot can provide immobilization of the hallux and the first metatarsophalangeal joint as well as would be expected of a full cast.

It should be pointed out that such splinting does not provide adequate first ray immobilization even if extended posteriorly to the heel. Weightbearing can displace even a splinted first ray in a patient who has undergone osteotomy at the base of the first ray.

Lesser Metatarsophalangeal Joint Splinting

1. Complete the bandaging of the forefoot and toes including generous padding of the toes.
2. Cut #125 celastic splint (one or more layers depending on rigidity desired) 2-3 inches wide and 6 inches long.
3. Shape the splints to the width of the underside of all the lesser toes with the splint extending from proximal arch all the way to the end of the toes.
4. The splint is dipped in acetone to activate the cellulose acetate.
5. The splint is laid on a bed of webril. A second layer of webril is used to cover the upper.
6. The splint is laid on the completely bandaged foot and held in position by an assistant (Fig. 38).

Fig. 38

7. Two inch kling bandage is used to bandage the splint into position (Fig. 39).

Fig. 39

8. The completely bandaged foot is covered with tubeqauze.
9. Several hours are allowed for thorough hardening of the splint.

Discussion

Splinting of the lesser toes and metatarsophalangeal joints is especially important in instances where Kirschner wires are present across the joints. There are two types of bending force that are present at the metatarsophalangeal joints in such patients. One is a flexor force and the other is extensor.

Often a Darby Trauma Shoe is built up with a 1/2 inch thick insole of felt or a 1/4 inch cork all the way forward to the web of the toes. This can serve to eliminate dorsiflexory force against the toes by eliminating the reactive force of the ground (Fig. 40).

Fig. 40

The second force is a plantarflexory force caused by weightbearing loading of the ray which in turn causes elongation of the ray and produces a plantarflexory pull by increased tension against the plantar apparatus. This latter force is not relieved by built up insoles. In fact the insole which relieves dorsiflexory force actually accentuates the flexor force. Celastic splinting effectively absorbs the plantarflexory force and prevents fatigue of the Kirschner wires.

The combination of the raised insole forward to the web and celastic splinting beneath the involved rays can effectively control the bending force which causes Kirschner wire fatigue and breakage.

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