CHAPTER FIVE

PLASTER TECHNIQUE

MANY failures in conservative treatment can be traced to inadequate plaster technique. A good manipulative reduction is often allowed to slip during the clumsy application of plaster. The surgeon who aspires to skill in the conservative method must subject himself to a long apprenticeship in ' plastercraft.' Skill is not to be learned from books but only by continuous repetition for at least one year, and the casualty officer who regards the application of plasters as a menial task to be delegated to juniors or to the nursing staff will be well advised to transfer his attention to another specialty. Until the surgeon's hands have acquired an automatic rhythm, being able to pass and mould the turns of bandages quickly, regularly, and subconsciously, his mind is not free to devote its entire concentration to the tissues of the fracture.

PADDED AND UNPADDED PLASTERS

Plaster casts can be divided into three types: (1) ' badly padded ' plaster, (2) unpadded plaster, and (3) padded plaster.

' Badly Padded ' Plaster

It was against the background of the badly padded plaster that Böhler inveighed with such effect, and it was Böhler's teaching which established the use of the unpadded plaster, applied directly to the skin without any soft material intervening. So powerful were his convictions that even now the word padding is still regarded in many circles as something unmentionable or as something for which to apologise. It will later be seen that in this book the skin-tight plaster is not recommended for general use; I believe that when properly applied the padded plaster is just as efficient as an unpadded one, is much more comfortable, and has certain subtle advantages.

The badly padded plaster can be quickly dismissed; it is loose on the limb and cannot therefore fix the fragments. **Unless the surgeon pays extreme attention to detail in using padding correctly he will produce a badly padded plaster before he realises it.**

Unpadded Plaster

This type of plaster is made by applying the turns of wet bandage directly to the skin without the intervention of any textile. The closeness of its application to the limb, and to some extent the actual adhesion to the skin, is believed by some to enhance the fixation of a fracture. In Böhler's original technique not even stockinet was allowed between plaster and skin. Even if stockinet is used

the plaster which results can still be regarded, for all practical purposes, as an unpadded cast.

Provided that certain elementary points in technique are observed there is no danger in the skin-tight plaster. It is important that the bandage should never be pulled tight, as when applying an ordinary cotton bandage to hold on a dressing. In the unpadded technique the bandage should be made to *roll itself round the limb*. By laying the wet roll of plaster on the skin and pushing it round the curves of the limb with the flat of the hand it will be made to find its own way without causing tight ridges. In no circumstances should the roll of plaster be lifted off the limb and pulled. The technique is one which is quite easily learned, though like any technique it takes many months to acquire sufficient skill to produce a masterly finish. *This technique is considerably easier to acquire than is the padded plaster technique.*

Though the padded plaster is the one which the writer recommends for general use there are at least three conditions where the unpadded plaster is essential: (1) all plaster strips or slabs should be applied direct to the skin (as in the Colles' fracture) and (2) the scaphoid of the wrist; and (3) the Bennett's fracture should always be treated in unpadded plasters.

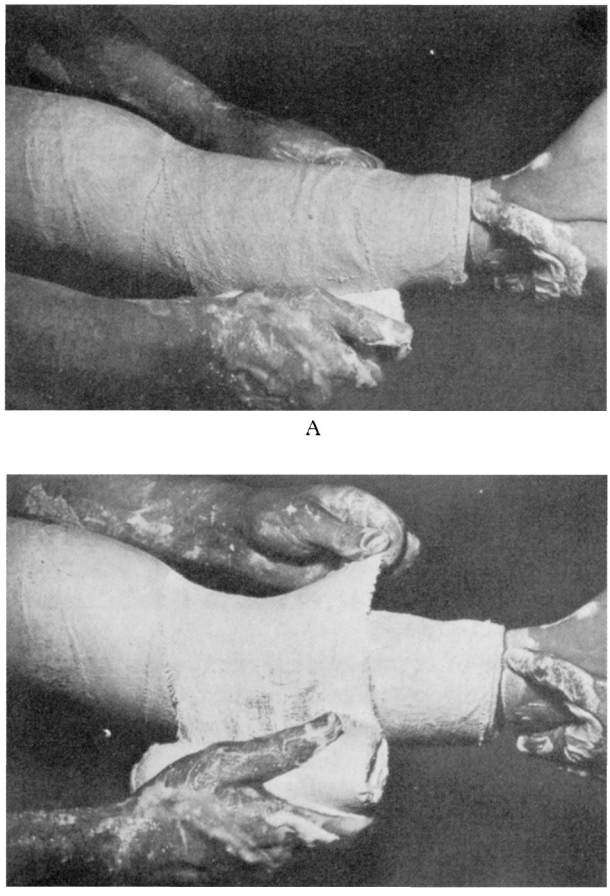
Padded Plaster

The real merits of a padded plaster cannot be appreciated until good examples of the technique are examined. My own interest in this type of cast was first stimulated by examining the work of visitors to Britain trained in the Bologna School (Morandi, 1948).

In this method a layer of cotton-wool is interposed between the skin and the plaster, which is then firmly compressed against the limb by applying the wet plaster bandage *under tension*. Instead of the wool rendering the plaster loose, **the elastic pressure of the wool actually enhances the fixation of the limb by compensating for slight shrinkage in the tissues after application of the cast.** The amount of tension used in pulling tight the individual turns of plaster is difficult to describe; it can be surprisingly high and yet it never appears to cause any embarrassment to the circulation. When expertly applied I feel quite sure that these plasters grip the limb more firmly and keep this grip for a longer time than do skin-tight plasters. I have often heard intelligent patients, treated in a so-called skin-tight plaster for fractures of the tibia, say that their legs were quite loose inside their plasters on getting up in the morning, and that they could only bear weight with comfort when their legs had again swollen to fit the plaster tightly.

In the padded plaster technique the cotton-wool is carefully applied as an even layer of rolled wadding. Depending on the thickness of the wadding, sufficient turns should be applied to build up a layer of loose wadding measuring about half an inch in thickness which will later be compressed by the overlying plaster to about an eighth of an inch. **The care with which this layer of wool is applied is essential for success; it must not obscure the shape of the limb by being put on in careless and ugly lumps.** The sheet wadding, if it is not already rolled, should be carefully prepared in rolls before application.

In applying the plaster the method of applying tension is difficult to describe; the action of putting on each turn lies half-way between an ordinary bandaging movement in which the roll is lifted off the limb, pulled, and 4 or 5 inches of



A

B

FIG. 69

Method of applying plaster bandage over padding.

A, Applying tension to the bandage by pressure of the thenar eminence exerted in the middle of the bandage so as to avoid cutting-in of the edges.

B, Making a tuck to accommodate the tapering limb.

stretched bandage then wound round the limb, and the unpadded technique where the roll of bandage lies continuously in contact with the limb. The roll of bandage remains in contact with the surface of the limb almost continuously but instead of being lightly guided round the limb it is *pressed* and *pushed* round the limb by the pressure of the thenar eminence under a strong pushing force directed in the length of the surgeon's forearm. The technique is illustrated in Fig. 69, A. It will be seen that pressure is applied through the surgeon's thenar

eminence at the middle of the width of the bandage so that no excess of pressure can fall on either edge of the bandage and so cause a sharp ridge. Each turn is applied slowly and is settled carefully in position, the surgeon's hands following the natural inclination of the bandage without forcing it unduly in any uneasy direction. At tapering parts of the limb the turns are made to lie evenly by small tucks, made with a quick movement of the index finger of the left hand before each turn is smoothed into position (Fig. 69, B). *The durability of the cast and its strength for a given lightness depend on the welding together of the individual turns by these smoothing movements of the left hand*; it is erroneous to imagine that the first and the last layers are the only ones which need to be applied carefully; every layer must be applied with equal deliberation.

FIG. 70

Technique of applying plaster at the toes. Each toe is wrapped with a twist of wool and then all together in a turn of sheet wadding. The plaster is applied over the toes and then cut back to the desired level. By this means adequate space is left for movement of the digits. (*Dr Casuccio.*)

It will be seen from the above description that this technique precludes the use of plaster slabs; the whole cast is built up from circular bandages.

In applying the bandage it is difficult to advise as to how much tension must be used. It is surprising how much tension can be tolerated if it is evenly distributed over a large surface area; I have never yet applied one of these plasters too tightly. In below-knee plasters it is important that the bandage should be pulled very tight indeed in the proximal part because, unless the wool and the soft muscles are both powerfully compressed, it will be found that the plaster when completed will be as loose as a Wellington boot; in the distal part of the plaster round the ankle the tension must be less, but even so it must be enough to make the wool spring at each turn of the bandage.

In Fig. 70 is shown a method of padding each toe separately with a wisp of wool; this enables the toes to have freedom of movement when the wool is picked out after hardening of the plaster.

'End-to-end Rhythm'

The hall-mark of a good plaster is that it should be of even thickness from end to end. It is only too common to find plasters, such as those for the scaphoid or the Pott's fractures, which exceed even half an inch in thickness at the wrist or ankle and yet taper away to one layer of bandage at the upper and lower apertures (Fig. 71). These plasters are not criticised on æsthetic grounds alone but because they fail to fix the fragments by being functionally too short. If the lower aperture of a forearm plaster is too thin the accurate modelling of the plaster to the palmar creases is valueless, and movement of the wrist becomes possible through a considerable range.

The cast which tapers in thickness towards each end results from the surgeon being *obsessed by the region of the injury* and failing to think of the plaster as a whole. A cast of even thickness throughout is more easily produced if the bandage is applied without thinking about the site of the injury and *by deliberately concentrating on making the two ends of the cast of adequate thickness.* The surgeon should discipline himself **never to apply two turns in the same place except at the ends;** this can be done by establishing a progressive 'backward and forward rhythm' from the top to the bottom of the plaster (Fig. 72).

Quick-setting and Slow-setting Plaster

Since the publication of the early editions of this book the manufacturers of proprietary plaster bandages produce grades which are very satisfactory and which do not set too quickly.

It is an essential point in plaster technique that the first bandage to be applied should still be soft when the last is finished. If the plaster is soft the surgeon can feel a mobile fracture through it and be able to mould it as he wishes. **One of the commonest causes of defective reduction is that the plaster is allowed to reach the consistency of wet cardboard before the final turn has been applied;** the surgeon is then unable to feel any movement of the reduction which he is striving to secure. When using the padded plaster technique, with its deliberate passage of each turn under tension, the use of quick-setting plaster is a serious mistake because this kind of plaster always takes a little longer to apply than the unpadded cast.

One of the commonest causes of premature setting, due to slow application of the plaster, is a tendency to use a large number of narrow bandages. While there are rare occasions when 4-inch bandages may be needed, I strongly recommend that the 6-inch and 8-inch bandages should be regarded as the standard size for anything except fingers. The 6-inch bandage should be used for the forearm and the 8-inch bandage for the ankle. Many surgeons only think of the 8-inch bandage when plaster jackets or hip-spicas are in mind.

The importance of infrequent plaster changing needs repeated emphasis. The ill effects of changing plasters in precipitating delayed union makes all the more obvious the importance of a skilful plaster technique. **A cast should never be applied carelessly with the thought in the surgeon's mind that**

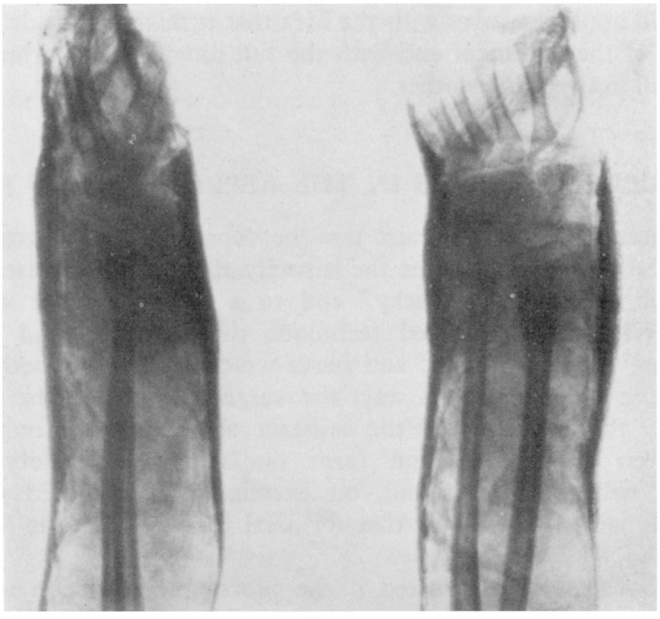


FIG. 71

A badly applied plaster. The surgeon has been obsessed by the level of the injury; the effective length of the cast is too short because the upper and lower limits are thin and ill-defined.

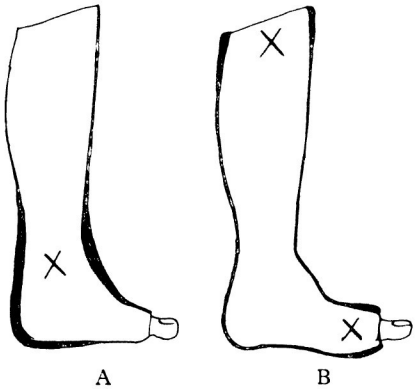


FIG. 72

A, By concentrating too much on the site of the fracture there is a tendency to produce a thick plaster with thin extremities.

B, By concentrating on the extremities of the plaster the site of the fracture will generally look after itself, and a light rigid cast will be obtained of equal thickness throughout. In this method no two turns of plaster are ever applied in the same place except at the extremities (the ' backward and forward rhythm ').

it can be changed 'next month' if it turns out to be imperfect; the surgeon should apply a plaster with the idea that it might be made to last for the whole period of the treatment and with the full intention that when it comes off the patient will not require another.

THE TRIPLE SEQUENCE IN THE APPLICATION OF PLASTER

The application of plaster must now be considered in an actual reduction. There is a great difference between the leisurely application of plaster to a healing fracture which is clinically 'sticky' and to a recent fracture with a mobile deformity. Without a rehearsed technique the reduction and fixation of a mobile fracture is often a hectic and nerve-wracking business with surgeon and assistant getting in each other's way, the surgeon impeding the application of the plaster by the assistant and the assistant obstructing the reduction by the surgeon. Even if the reduction turns out to be satisfactory under these conditions it will often be found, on examining the finished cast, that the position of the joints may not be that for ideal function (*i.e.*, the foot may be in equinus, etc.).

These difficulties are eliminated if the process of reduction and fixation is regarded as possessing *three distinct phases*. These phases, though generally applicable, are seen at their best in the reduction and fixation of a Pott's or Bennett's fracture.

Phase 1. Examination and rehearsal.
Phase 2. Plastering.
Phase 3. Reduction and holding.

1. Examination and Rehearsal

The first phase of the sequence is given up entirely to an examination of the displacement and to making an assessment of the forces required to reduce and hold the reduction. In this phase the **effect of gravity** on the displacement must be remembered, as it is often of very great importance. The position of the limb must be discovered which makes use of gravity in holding the reduction or, alternatively, the position must be found where any undesirable effects of gravity can be eliminated. The **amount of force** needed to correct the displacement must be assessed and the **range of excursion** from the position of greatest deformity to the position of apparent reduction must be committed to memory. Sometimes it will be found that the reduction can be held by a minimum force applied at a key point; in this case the **key point** must be localised for future reference.

The examination and rehearsal is not complete until the surgeon is sure that he can reduce the fracture with one or, at the most, two purposive movements and hold it in reduction without persistent and indecisive 'fiddling' movements of his hands.

2. Plastering

With the knowledge gained from the previous phase placed temporarily on one side the plaster must now be applied. To do this the limb is held by the assistant in the position of approximate reduction. It is my belief that the surgeon himself should apply the plaster because the surgeon alone appreciates the urgency of the situation. The quick application of plaster must not be impeded by attempts to hold a precise reduction. The cast is applied as quickly as possible, so that it is still completely soft by the time the last turn is applied. A slow-setting plaster is necessary for this purpose; if the cast is a large one, the final touches should not be added at this stage—at this stage only sufficient plaster should be applied to hold the reduced position temporarily; the plaster can later be made thicker and completed at its upper and lower limits.

3. Reduction and Holding

Sufficient plaster having been applied just to hold the fracture when set, the surgeon now takes the limb from the assistant and prepares to apply the rehearsed movement of reduction. With the plaster wet and soft he should be able to recognise clearly the sensation of reduction which he learned in Phase 1, though now it will be rather muffled by the intervening plaster and wool. Having applied the rehearsed movements of reduction he holds on, without further agitation of his hands, until the cast has set. During the last few minutes of the setting he can move his hands a little to obliterate any abrupt local impression which might invite a pressure sore. The cast is now completed to the required final thickness and the upper and lower limits shaped to limits appropriate to the case.

FUNCTION WHILE IN PLASTER

In promoting function while in plaster a simple clinical fact needs mention because it is often overlooked; perhaps it is overlooked because it is so obvious. **When the decision is made to remove a plaster it is unwise to do so if the patient is not by this time already capable of good function in the plaster.** Thus in the case of a Pott's fracture at ten weeks, it is unwise to remove the plaster if the patient is walking badly or walking only with the assistance of a stick. If the plaster is taken off at this stage it will be found in all probability that the patient may need two sticks, or even be unable to walk at all. If a patient is walking badly, and needing a great deal of assistance from a stick, the reason should have been discovered and put right long before the calendar time for removal of the plaster has arrived. There are three common causes of defective function in a walking plaster:

1. *An Uncomfortable Plaster or Bad Walking Heel.*—The plaster may have been uncomfortable for weeks as a result of being badly applied; the patient often thinks that pain is to be expected from a fracture and does not report it. **If the plaster is a bad one, the patient may never be able to learn to walk while he is in the cast.**

2. *Failure of Psychic Rehabilitation.*—The patient may not have received the encouragement necessary to show him that he *can* walk; he may never have seen other patients in the same type of splint playing games or exhibiting some similar example of robust function. The importance of a **cheerful rehabilitation service in close contact with the surgeon cannot be over-emphasised; it should never be a separate service in a general hospital with divided loyalty to a separate director.**

3. *Bone Atrophy.*—Post-traumatic osteodystrophy is an obscure but fortunately rare condition. In these cases, after removal of plaster, the limb swells and may become even more painful than before. It is my present opinion that these cases are best left in plaster for a very long time, and certainly left until good function has been obtained while still in plaster. Fortunately these cases are rare; the more expert the fracture team the less frequently they are seen: an observation which tends to suggest that they are possibly the result of treatment in plasters which have been too tight or plasters which have been painful for many weeks and have induced a superadded hysterical state of disuse. The condition is rarely seen in the phlegmatic type of patient who is unafraid of his injury and who has confidence in his surgeon.

ERRORS IN APPLYING THE PADDED CAST

1. Attempting to plaster at the same time as attempting to hold a precise reduction.
2. Applying wool carelessly and in shapeless lumps instead of having it previously neatly prepared in rolls and bandaging it on with very great care to give an even layer.
3. Not bandaging tightly enough, with the result that the finished plaster is loose.
4. Not bandaging the fleshy proximal part with greater tension than in the bony distal part, resulting in a below-knee plaster of the 'Wellington boot' effect.
5. Failing to recognise the sensation of reduction through plaster, as a result of using quick-setting plaster which becomes stiff too quickly.
6. Failing to recognise the sensation of reduction, from inadequate examination during the initial phase of reduction.
7. Applying the plaster carelessly on the supposition that there is no harm in changing it at any time.

Windowed Plasters

Generally speaking, the making of windows in plasters is not a policy to be encouraged. The danger of œdematous tissues herniating through a window, especially in plasters on the lower extremity, and the theories of Winnett Orr on the closed plaster treatment of osteomyelitis, have made many people regard the windowing of plasters as a surgical crime.

Provided, however, that certain technical matters are observed in nursing a windowed plaster, there are numerous occasions on which it can be used to advantage, although the advent of antibiotics has probably made even these occasions less frequent than formerly.

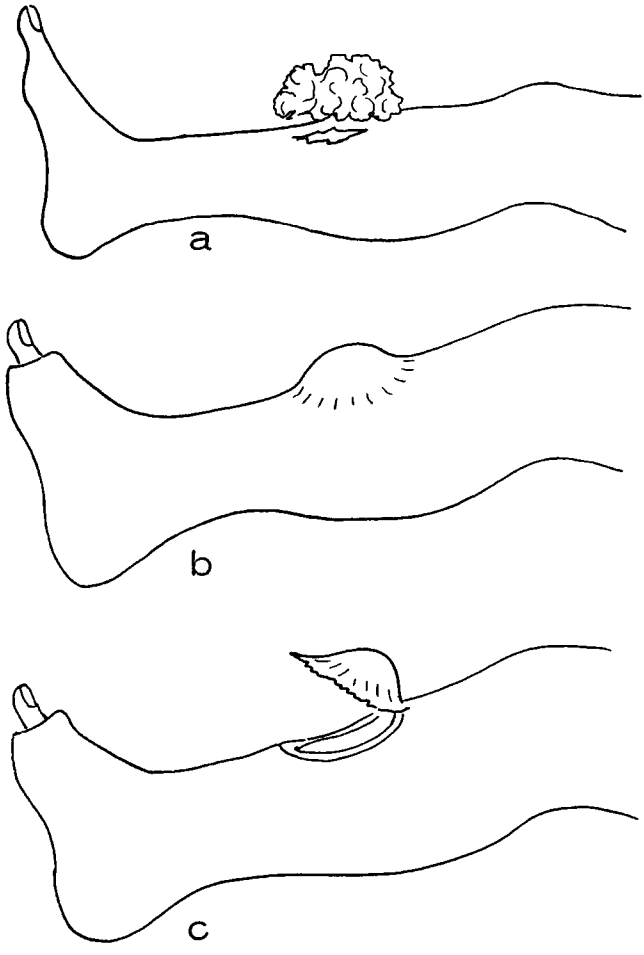


FIG. 73

Simple method of locating a window accurately over the desired point in a plaster. Firm lump of wool applied over wound (a), causes a visible bulge in the finished plaster (b), which can be cut off with a sharp knife (c).

In the recent world war it was a frequent experience to find that compound fractures discharging copious pus seemed to reach a standstill in their healing after about three months in closed plaster. Beyond this time the decomposing discharges accumulating in the plaster seemed to become irritant and caused excoriation of the surrounding skin, prevented the growth of new epithelium, and produced exuberant unhealthy granulation tissue. If the plaster was windowed

in this type of case, and a few daily dressings performed, a remarkable improvement in the condition of the tissues was noticeable within a few days. Similarly, in cases where a compound fracture had been grafted with pinch grafts or Thiersch grafts, in the presence of slight infection, it was found that the grafts tended to dissolve, after a preliminary ' take,' unless the graft was washed at about the fourth day through a window in the plaster.

If it is decided to use a windowed plaster, the patient should as far as possible be discouraged from holding the limb too long in a dependent position, and for this reason the method is not to be advised in ambulatory plasters. It is also important that the wound should be under pressure from a properly designed pad of wool firmly bandaged into the aperture of the window. The maintenance of this local pressure on the wound has a beneficial effect on wound healing, and it is indeed a paradox that the windowed plaster, far from causing window herniation, can be the means of enhancing local pressure over the wound in a way which is impossible in a closed plaster.

To maintain local pressure in the window a pad of wool should be built up to project, in the uncompressed state, about 2 inches above the level of the window. The pad should fit the window like a piston and not extend on to the surface of the plaster beyond the edges of the window, as this would defeat the piston-like action of the pressure pad. It is necessary to apply the bandage under sufficient pressure to cause the patient slight initial discomfort when it is first applied.

Not infrequently a surgeon may be unwilling to window a plaster if he has to do it himself, because of the labour which the cutting of the hole can entail. Even if an electric plaster saw is available it often happens that the window is made over the wrong site, and when it is fully extended to encompass the wound it has become unnecessarily large. It is an important point that *windows should be kept as small as is compatible with their purpose*, and for this reason they should be centred accurately over the discharging sinus. A useful technical hint is to apply a piece of wool—rolled firmly into a ball or sausage shape and slightly smaller than the size of the wound—over the centre of the wound before applying the plaster bandage. The result will be that when the plaster is complete the ball of wool will produce a ' bleb ' situated exactly over the centre of the wound. The top of this bleb can then be sliced off with a sharp knife held parallel to the surface of the plaster and without any danger of cutting the patient. If the plaster is allowed to dry, the top of the bleb can be cut off with a saw held flat on the surface of the cast, and once the central hole has been made in the correct position it is a simple matter to enlarge it with a sharp knife (Fig. 73).

REFERENCE

MORANDI (1948). *Technica degli Apparecchi Gessati.* Bologna : Scientifiche Instituto Rizzoli.