

The magic of moulding - Applying upper limb cast in a child

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Abstract

Upper limb fractures are common in pediatric population. Most of these injuries need application of cast as a routine procedure. The purpose of this review is to discuss the art of applying a well moulded upper limb cast in children in order to get excellent outcome. Material to be selected for cast application depends on the fracture configuration, requirement for moulding, and other physical properties of the cast required for particular patient. A well –moulded cast should be applied in order to prevent further fracture displacement. It is important to understand and maintain certain radiographic indices in order to ensure a good outcome from casting technique. Preventing cast related complications like wet cast, skin complication, compartment syndrome, thermal injuries, and cast syndrome are important consideration when taking care of the cast. Patient education is one of the most important factor in ensuring proper cast maintenance.

Keywords: Pediatric fractures, Upperlimb cast, Casting, Cast technique, Cast complication

Introduction

Application of cast in the upper limb in a child with perfect technique and maintenance without any complication is an art learnt by practice. Children have a special set of complications which include poor application, loss of reduction within the cast and loose cast that slide off. On other side of spectrum children usually do not complain if cast is irregular or too tight with ulceration noticed when the cast is removed.

Material choices for Cast application

Standard material used for cast application over the past 150 years has been Plaster of Paris. Plaster of Paris is gold standard and conventional material used in casting with its own advantages and drawbacks. The biggest advantage of using plaster of Paris bandages is its

ability to mold more easily and allow reduction of fracture and maintenance when the plaster is setting. The major drawback is its poor resistance to water and low strength to weight ratio compared to synthetic counterpart. (1) Newer cast material in form of synthetic cast by fiberglass / polyester is more expensive than plaster of paris. Synthetic cast material is light weight more rigid and allows maintenance of cast for longer duration when needed. These casts can be made water proof by using synthetic material along with synthetic cast padding both of which are individually water proof.

Cast application technique:

Upper limb cast application in children is a well learned art which needs practice and can be mastered by repetitive

applications and experience. Cast applications included many elements which are type of material used, amount of material used, presence or absence of stockinet, type of cast padding, method of rolling of plaster and final cast shape and position. There is a great emphasis on well-molded cast to maintain reduction and prevent worsening of position within the cast. (2,3).

Rolling technique of plaster is most important in order to prevent complication of cast tightening. While applying the cast it is mandatory that the cast bandage be un-rolled onto the extremity and not pulled onto or wrapped tightly in a fashion which can be constricting. Excessive focused pressure over a small surface area of the cast can lead to decreased perfusion and cause pressure sores. The person applying the cast should be constantly aware of their hands in addition to the assistant's hand so that they do not remain in one position for too long to cause pressure. Avoiding wrinkles and uneven ridges in the cast are important to cause even

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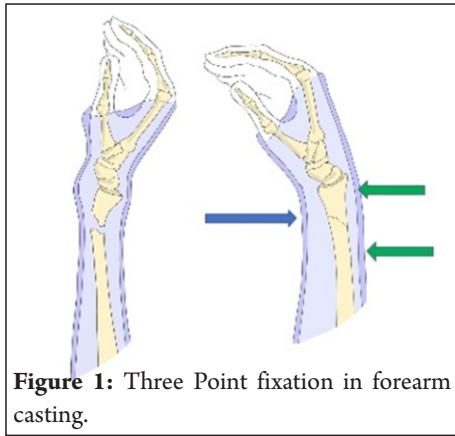


Figure 1: Three Point fixation in forearm casting.

pressure distribution over the extremity.

Upper limb casting pearls in children

Length of the cast

Distal 1/3 radius fracture with stable DRUJ and juxtaphyseal fracture of distal end radius do well in short arm below elbow casts. More proximal fractures are better maintained with long arm above elbow casts. (4,5).

Padding

Just about right layers of padding are enough to give good cast. Approximately 2 or 3 layers of paddings with good padding over the bony prominences such as radial and ulna styloids, olecranon and preventing wrinkling while application of soft roll or padding.

Cast Molding

Proper cast molding ensures good cast fit decreasing chances of loosening, loss of reduction and even chance of cast sores. Charnley’s three point fixation technique

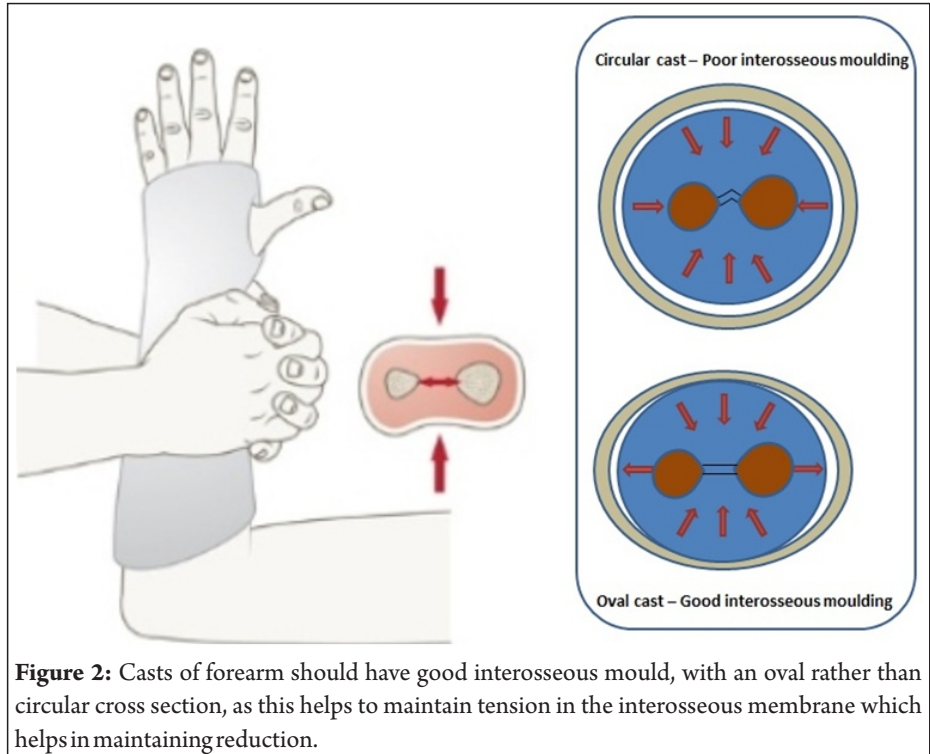


Figure 2: Casts of forearm should have good interosseous mould, with an oval rather than circular cross section, as this helps to maintain tension in the interosseous membrane which helps in maintaining reduction.

while molding the cast is necessary to keep the fracture aligned with a good interosseous mold. Three point fixation is achieved by molding at the apex from one side and above and below the fracture from other side.[Fig. 1].

When treating both bone forearm fractures it is important to mold the cast by anteroposterior gentle compression to get oval shaped cast in cross section with coronal width more than sagittal width to get cast index of 0.7. [Fig. 2].

Radiographic Indices [Table 1]

Various radiographic indices are

described in literature to access quality of fracture of reduction and cast application so as to correlate with outcome prognosis. [Table 1].

Cast index

Cast index is defined as the ratio of inner diameter of cast in lateral view to that in AP view measured at the level of fracture. (4) [Fig. 3] Chess et al in 1994 had suggested a cast index of 0.7.(5) If the ratio is equal or less than 0.8 the fracture has approximately 5% of displacement as opposed to 26% chance for an index greater than 0.8. [Fig. 4].



Figure 3: XRAY picture illustrating index.

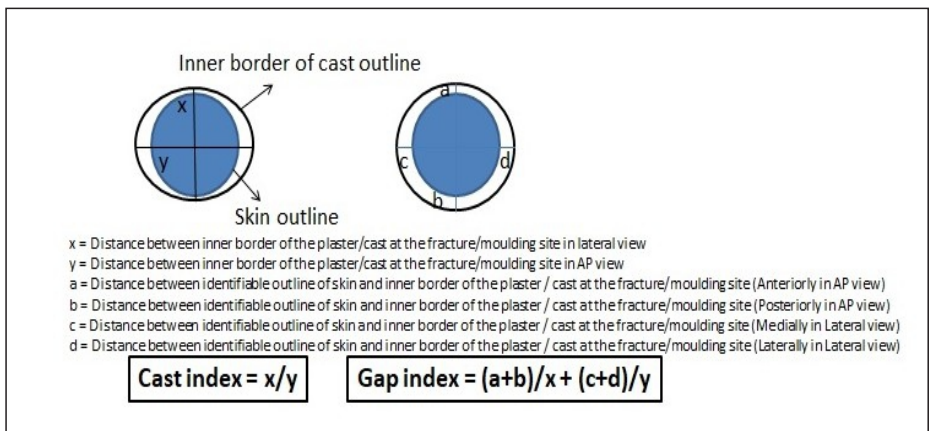


Figure 4: Cross-section figure illustrating Cast index and Gap index.

Table 1: Radiographic indices used to assess quality of fracture reduction and cast application

Index	Author	Description	Desired value
Cast index	Chess <i>et al.</i> [5]	Inner diameter of cast on lateral view/inner diameter of cast on AP view (At level of fracture)	<0.8
Padding index	Bhatia and Housden [6]	Dorsal gap on lateral view (at fracture site)/maximum interosseous distance on AP view	<0.3
Gap index	Malviya <i>et al.</i> [7]	(Radial gap + Ulnar gap/inner diameter of cast in AP view) + (Dorsal gap + volar gap/inner diameter of cast in lateral view)	<0.15
Canterbury index	Bhatia and Housden [6]	Cast index + Padding index	<1.1
Three point index	Alemдарoglu <i>et al.</i> [2]	(Distal radial gap + ulnar gap + proximal radial gap/transverse distance of cortical contact on AP view) + (distal dorsal gap + volar gap + proximal dorsal gap/transverse distance of cortical contact on lateral view)	<0.8
Second metacarpal radius angle	Edmonds <i>et al.</i> [8]	Angle between the second metacarpal and long axis of radius on AP view	>0 deg

Conclusion

Casting was one of the first methods of fracture treatment and remains as one of the most common modes of treatment.

Perfecting the art of casting remains crucial in ensuring optimal patient outcomes and preventing significant healthcare expenses related to

prevent thermal injury to provide an optimal cast experience.

complications.

The ideal cast has a long list of factors that need to be considered to ensure a high quality of patient care. A good cast should immobilize the extremity, remain comfortable, and not cause complications. These factors include the type of cast material and how much padding to apply at certain areas of the extremity. Afterwards, educating the patient and family on how to prevent the cast from getting wet will assist in maintenance, comfort and anxiety. Finally, learning how to properly use a cast saw to

Declaration of patient consent: The authors certify that they have obtained all appropriate patient consent forms. In the form, the patient has given his consent for his images and other clinical information to be reported in the Journal. The patient understands that his name and initials will not be published, and due efforts will be made to conceal his identity, but anonymity cannot be guaranteed.

Conflict of Interest: NIL; **Source of Support:** NIL

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