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Commentary

Evolution of Casting and Splinting in Orthopedic Immobilization

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DESCRIPTION

Since 3000 BCE, immobilization methods have gradually changed, moving from conventional plaster to contemporary synthetic casting tape and other sustainable immobilization methods. The quest for superior casting materials with outstanding mechanical and load-bearing capabilities, non-toxicity, great healing rates, patient satisfaction, and environmental friendliness is what's fueling this revolution. Despite the development of new materials, classic plaster is still preferred due to its good skin conformability, low cost, and accessibility.

Modern orthopedics typically uses immobilization techniques like casting or splinting to address fracture healing, post-operative care for orthopedic trauma, and support for structural deformities. By minimizing injury to the surrounding soft tissues and the neurovasculature and limiting mobility at the fracture site, immobilization aids fracture healing. Direct osteonal remodeling is possible with minimal to no exterior callus formation when mobility is restricted at the fracture site under firm stability. Direct bone restoration is what is referred to as "primary healing." Direct bone repair can also take place when interfragmentary stability is less firm and a modest amount of mobility occurs. There is either intramembranous ossification in the periosteum or endochondral repair at the fracture site. External attachments and immobility in orthopedic casts or splints can cause this disease. Higher levels of interfragmentary mobility can lead to hypertrophic nonunion at the fracture site, which can affect the fractured bone.

Even though surgical pin fixation is recommended for the treatment of unstable severe fractures, cast immobilization is still used as a follow-up procedure. The immobilization time for a fracture typically ranges from four to six weeks, depending on the type of fracture and the complications present.

For the short-term immobilization of stable or simple fractures as well as soft tissue strains and sprains, splinting is preferable over casting for the long-term immobilization of definitive or complex fractures. Splinting is used to give immediate post-injury immobilization that accommodates swelling because casts only provide strict circumferential immobilization. Moreover, congenital musculoskeletal deformities such as clubfoot, hip displacements, and scoliosis, as well as diabetic foot care, can be corrected with casts and splints.

It's crucial to understand the neurovasculature and the surrounding anatomy before immobilization. It is important to check the skin for any blemishes, inflammation, or soft tissue injuries. To reduce cast problems, it is essential to evaluate the five Ps: Pain, pallor, pulselessness, paresthesia, and paralysis. To avoid morbidity, certain casting materials and processes are recommended in high-risk patient groups such as pediatric patients, patients with multiple traumas, unconscious patients, patients under anesthesia, and children with developmental abnormalities. However, temporary immobilization with a splint is advised when the fracture site is prone to edoema and bleeding.

Cast installation must be done by skilled orthopedic technicians or medical professionals to assure good fracture alignment and few problems. The limb must be positioned in the preferred posture for comfort as part of the correct application technique. Casts can be put on as a total contact cast, which is put on over a stockinette sleeve and layers of padding, or they can be put on directly over the skin.

Plaster casts are theoretically easier to apply than other cast materials. For the patient's comfort, a stockinette is first placed on the skin, followed by a cushioning wrap. To accommodate any post-traumatic swelling, practitioners can cut a slit along the padding's whole length and place a layer over the slit that is roughly three-quarters of the way around. For padded ends and improved cast airflow, the stockinette sleeve's ends can be folded back over the padding. The bandages are then placed in lukewarm water and soaked in plaster or synthetic tape. Between 32 °C and 39 °C is the preferred dip water temperature. Plaster and synthetic glue deposits that could raise the temperature of the dip water should be removed by changing the water after each application. To prevent exfoliative dermatitis and skin irritation, practitioners are advised to wear gloves when working with synthetic casting material.

Bandages made of plaster or synthetic materials are placed rather than pulled. The use of a particularly thick amount of padding

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can weaken the plaster because casts are typically put over a layer of padding. The perfect cast must be both strong and lean. In general, plaster casts use 7 to 8 layers of bandage, while fiberglass and other synthetic casts use 3 to 4 layers of synthetic tape. To ensure bonding between layers for stronger and lighter casts, rub each layer before the next layup. A sufficient amount of power must be supplied during the operation since rubbing under pressure can harm the underlying neurovasculature. It was applied without the use of water, and a water-based gel was used to activate the resins on the fiberglass tape as an alternative to the standard application method.

When fiberglass and plaster bandages are dipped in tepid water, quick dipping and forceful squeezing off of the water might make the casts hotter due to inadequate water temperature, leading to cast burns. The compressive strength of plaster castings steadily decreases with longer soaking times (>4 min) and hotter dip water temperatures (>95 °F). So, for a stronger and safer cast application, technicians must carefully monitor the temperature of the dip water and the soaking period.

The castings must be totally dry for effective immobilization. This is dependent on the material and cast thickness. A plaster cast needs 36–72 hours to dry completely, and lengthy leg casts and hip spica casts can only be worn with weight after 48–52 hours. Nevertheless, fiberglass and other synthetic cast materials cure in 25 to 30 minutes and are immediately weight-bearing after hardening. The application, duration of immobilization, material availability, and cost considerations all play a role in the choice of the casting material.