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Journal of Bone Research

Opinion Article

Requirements of MIS Method in Bone Surgery

Xiubao Chang*

Department of Orthopedic Surgery, Mayo Clinic College of Medicine, Minnesota, USA

DESCRIPTION

In many reconstructive orthopedic surgeries, resection of bones is performed. While in the surgery process to create bleeding surface planes in the bone, the mostly used tool is electrically powered oscillating saw. However, most of the saws in use are heavy, and manual handling of them necessitates extensive training due to the high risk of overshooting and causing soft tissue damage in the surrounding area. The surgeon's assistant uses clamps around the bone to protect the surrounding tissue. Unfortunately, these clamps necessitate a bigger incision and only protect the neighboring bone tissue, leaving the opposite tissue unprotected relative to the incisional entry point. Upper limbs, pelvis, and spine osteotomies are common, while lower limb osteotomies are more common.

The therapeutic need was to build a reusable sawing device that was small, inexpensive, and efficient while avoiding tissue damage. The wire saw was used to cut bone in this investigation, despite the fact that there are many other options for cutting materials. A wire saw is positioned around the bone and then directed away from the neighboring tissue through the bone, unlike an oscillating saw, which requires a force applied towards the bone and tissues from above to cut. This eliminates the risk of the cutting blade jumping or overshooting into the surrounding tissue during the surgery. An osteotomy solution that permits the wire saw system to be used as a Minimally Invasive Surgical (MIS) instrument has been developed to further reduce tissue damage.

To develop a reusable MIS bone cutting system, it has to fulfill some requirements, because human bones come in a variety of sizes, an adaptable system that can be used on bigger diameter bones with a minimum of 25 mm and a maximum of 40 mm is required. For easy cleaning and quick replacement of broken components, the system must be modular. It is critical to ensure minimal tissue damage and a short procedure time in order to minimize the healing period and infection risk as low as feasible. To reduce the amount of time it takes for the wound to heal, the incisions should be as small as possible to allow the wire-saw to enter. To avoid osteonecrosis, keep the temperature below 45 degrees Fahrenheit. A straight and clean cut is desired to realign the bone components following sectioning. It should not be possible to come into contact with the moving parts because of safety concerns. The instrument's assembly and disassembly should take no more than 2 minutes each. To ensure that the new solution is controllable during surgery, the wire saw's dimensions and mass should not exceed those of the oscillating saw. The wire's maximum length and mass should not exceed 200 mm and 500 grams, respectively. It should be possible to operate the wire saw system without the need of extra devices to keep procedure costs low and make the solution viable for application in low and middle income nations.

The devices used in the MIS bone cutting procedure include a curved tube with a clamp-shaped end, a cutting cable, a cable passer hook, and a needle. Before being spun around the bone, the curved hook is inserted along the side of the bone through a wide incision. A wire saw can be fed through the needle's cannula as soon as it is installed, and the needle can be removed, leaving the bare wire saw in place. Minimally invasive surgery is less hazardous than standard surgery because it employs tiny surgical incisions. However, even with minimally invasive surgery, there is a risk of anesthesia, bleeding, and infection complications.

Correspondence to: Xiubao Chang, Department of Orthopedic Surgery, Mayo Clinic College of Medicine, Minnesota, USA, E-mail: xbchang66@gmail.com

Received: 07-Apr-2022; Manuscript No. BMRJ-22-17664; **Editor assigned:** 11-Apr-2022; PreQC. No. BMRJ-22-17664 (PQ); **Reviewed:** 26-Apr-2022; QC. No. BMRJ-22-17664; **Revised:** 03-May-2022; Manuscript No. BMRJ-22-17664 (R); **Published:** 10-May-2022, DOI: 10.35248/2572-4916.22.10.165.

Citation: Chang X (2022) Requirements of MIS Method in Bone Surgery. J Bone Res. 10:165.