

# IMPROVEMENT ON A NEW LIGHTEST EXTERNAL FINGER FIXATOR TO CORRECT FLEXION DEFORMITY

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## INTRODUCTION

Basically, contracture that occur at the distal interphalangeal (DIP) or proximal interphalangeal (PIP) joint of a single finger due to trauma may reduce the functional capacity of the entire hand. Immediate physical therapy of the involved digit was done to prevent contracture and stiffness of the finger joints after trauma [1]. There were various techniques to manage the contracture but most of them are not uniformly successful. Application of external fixator to the deformed finger is one of the well known and still a reliable method to practice. AHS e-FingerFix previously design and tested on a cadaver test shown fine results with some limitations [2]. The rate of tension was expanded by the hinge and the shifting pin holder created friction (Figure 1). This study is to present modifications which took place on AHS e-FingerFix design for better treatment and simple technique to cure stiff DIP and PIP joints.

## METHODS

The new design consists of proximal, middle, and distal bracing segment which are adapted to stay in site relative to one another. Each bracing segment which adapted for attachment to pins embedded on the both side of the respective phalanx is then connected by a slotted guide. The slotted guide provides the proximal, middle, and distal clamping segments relative to each other and about the axle. A long threaded rod is linked to an adjustable hinge which is aligned with the kinematic axis of the DIP or PIP joint.

This alignment can be verified through the use of an X-ray machine, which can be used to align the radiolucent hinge directly over the axis of the DIP or PIP joint. A radiopaque hinge may serve as the axis of rotation of the joint and provide a mark for alignment of the slotted guide with the natural axis of the joint.

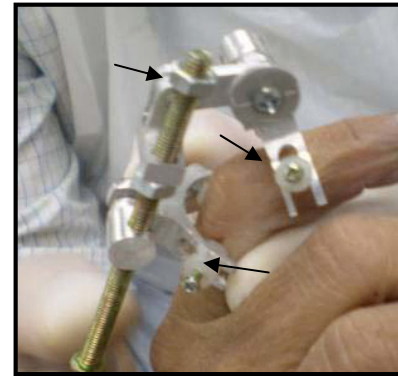
The threaded shaft is turned 360° by the patient; one turn gives 1mm joint distraction, thus allowing progressive passive extension or flexion. The angle of the insertion pins are between 0 to 65 degrees. Injury towards tendons and ligaments may occur if the angles are excluded from that range.

## RESULTS AND DISCUSSION

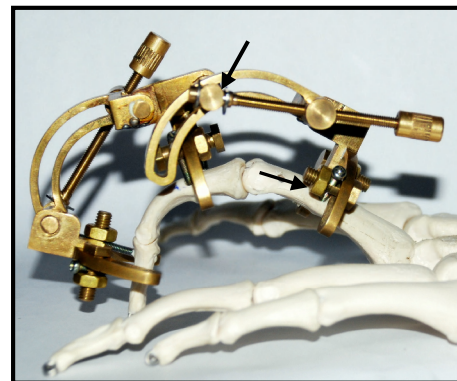
The new design of fixator allows phalanges bone to be stabilized without straining soft tissue or joints as occurred in the previous fixator. Major modifications were made at the pin insertion where a slotted bolt was customized to hold the pin in position. This slotted bolt eliminates high stresses which tend to fail the device.

The slotted guide (Figure 2) plays an important role to guide the treaded shaft according to the rotation of natural

finger. Eventually this mechanism helps a rapid recovery of contracture joint.



**Figure 1:** AHS e-FingerFix previously designed provides an extension up to 85% from initial range of motion. Arrows indicate high stresses and tension section which turned to fail the assembly.



**Figure 2:** The new external finger fixator assembled on skeleton model. Arrow marking shows the slotted guide which helps the natural rotations of joint and improvement of the pin clamping site by using slotted bolt.

## CONCLUSIONS

The design was investigated on a cadaver study and proven to have a better treatment which has simple techniques and quick to perform. This new design of AHS e-FingerFix has smaller size compared to normal external fixator thus treatment on multiple fingers with flexion deformity on the same hand is possible.

## ACKNOWLEDGEMENTS

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## REFERENCES

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2. Abd Rahman H.S, et al Proceedings of ISB XXI, Taipei, Taiwan, Abstract 530, 2007.