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Summary

Background: Digital amputations in the hand, in spite of being frequent, don't have any satisfactory reconstructive technique that allows simultaneously a good aesthetic and functional result. The distraction lengthening, one of the techniques of digital reconstruction, allows the lengthening of one or several rays simultaneously maintaining a sensitive and vascularised tissue in the lengthened area throughout the entire period of reconstruction.

Methods: Between 1998 and 2003, 11 patients were operated for reconstruction of 14 amputated fingers with Ilizarov distraction technique. Nine patients were male ($p < 0.001$). The mean age observed was 26.4 ± 18.9 years-old (mean ± standard deviation). We lengthened five fingers of the first ray (38.4%), four (30.8%) of the second ray, and four (30.8%) related to other rays of the hand. In two patients we made distraction lengthening of several rays simultaneously.

Results: The mean lengthening achieved was 28.2 ± 5.7 millimetres. For the functional evaluation, 72.8% of the cases where considered has good functional recovery. For the aesthetical evaluation, 27.3% of the cases where considered has good aesthetical recovery. After a mean follow-up of 25.8 ± 14.0 months we found two complications (one fracture of the callus bone, and one case of premature consolidation).

Conclusion: It is our conviction that the distraction lengthening has and will certainly still have an important role within the therapeutic options for finger reconstruction after amputation.

Keywords
Distraction– Hand– Patient evaluation

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Distraction lengthening in the traumatic hand

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Introduction

Several problems face those who take care of the traumatic hand. Besides the difficulties in the treatment of the acute phase, we should also consider those related to the treatment of the resulting sequels.

Digital amputations in the hand, in spite of being frequent, don't have any satisfactory reconstructive technique that allows simultaneously a good aesthetic and functional result. Those procedures usually consist in microsurgical transfer of a toe to finger, use of a prothese or the reconstruction with distraction lengthening.

There are two main techniques of distraction lengthening. The staged technique of distraction lengthening presented by Wagner, initially described for lengthening of the lower limb long bones, was adapted for digital lengthening by Kessler [3] and Matev [4] in the decade of 70. More recently, the technique described by Ilizarov [2] for distraction of the callus – distraction osteogenesis – of the long bones, has been adapted for the hand. These techniques allowed the lengthening of one or several rays simultaneously maintaining a sensitive and vascularised tissue in the lengthened area throughout the entire period of reconstruction.

This work presents the experience of the authors concerning digital amputation reconstruction with distraction lengthening by the Ilizarov method.

Technique

With the patient in a supine position under general or local anesthesia we place a tourniquet on the upper limb. Utilizing a drill machine we proceed with the insertion of two pins proximally and two pins distally to the place where bone division is planed. The pins should follow a dorsal oblique approach in order to limit the interference with hand function. Incision is made with a lancet by a dorsolateral approach only at the planed bone division site. Periostium is incised and elevated carefully only at the place of planed bone division. Any unnecessary trauma to the periostium should be avoided. The osteotomy is now performed under direct vision and if possible without the use of high energy instruments in order to avoid warming the bone. The periostium is then sutured with a 6-0 absorbable suture and the skin is closed with a 4-0 monofilament. We proceed with the assembling of the hardware and

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Distraktionsverlängerung bei Handverletzungen

Zusammenfassung

Hintergrund: Für Fingeramputationen stehen, trotz ihrer Häufigkeit, keine zufriedenstellenden Operationstechniken, die gleichzeitig ein gutes Ästhetisches und funktionelles Ergebnis bieten, zur Verfügung. Die Distraktionsverlängerung erlaubt, als eine der Fingerrekonstruktionstechniken, die Verlängerung von einem oder mehreren Strahlen, bei erhaltener Sensibilität und Gewebevaskularisierung über die gesamte Zeit der Rekonstruktion und Behandlung.
Methoden: Zwischen 1998 und 2003 wurden 14 Patienten mit amputierten Fingern mit der Ilizarov Distraktionstechnik behandelt. Neun Patienten waren männlich ($p<0.001$). Das mittlere Alter der Patienten betrug 26.4 ± 18.9 Jahre (Durchschnitt $\pm$ Standarddeviation). Wir verlängerten 5 Finger des ersten Strahls (38,4%), vier (30.8%) des zweiten Strahls und vier (30,8%) verteilt auf die anderen Strahlen. Bei zwei Patienten wurde eine gleichzeitige Distraktionsverlängerung mehrerer Strahlen durchgeführt.
Ergebnisse: Die Durchschnittliche Verlängerung betrug $28,2 \pm 5.7$ Millimeter. In 72,8% der Fälle konnte ein funktionell gutes Ergebnis erzielt werden. Die Beurteilung des ästhetischen Resultats wurde in 27,3% der Fälle als gut angegeben. Nach einem Follow-up von 25.8 ± 14.0 Monaten kam es zu zwei Komplikationen (eine Fraktur des Kallus und eine frühzeitige Konsolidierung).
Zusammenfassung: Wir sind davon überzeugt, dass die Distraktionsverlängerung eine wichtige Rolle bei den therapeutischen Möglichkeiten zur Rekonstruktion nach Fingeramputation spielt.

Schlüsselwörter
Distraktion – Hand – Patientenevaluierung

its connection with the pins. The lengthening begins on the fourth day for children and on the seventh day for adults with increments of 0.25 mm, four times a day. The hardware should previously be calibrated in order to notice how many turns are needed for one millimetre gain. The adjustment is made by the patient himself or if not possible by a relative.
After the desired length is achieved there is a need of an additional time for bone consolidation. That period is usually of two days for each millimeter of achieved length for patients under 14 years-old and of three days per millimeter for older patients. After a radiographic confirmation of bone consolidation, the distraction hardware is disassembled and the pins are took off usually in ambulatory and without any anesthesic act.

Patients and methods

Between 1998 and 2003, 11 patients were operated in the Plastic and Reconstructive Surgery Department of Centro Hospitalar São João (Table 1), for reconstruction of 14 amputated fingers with distraction techniques. The Ilizarov technique of distraction osteogenesis was employed.
A unidirectional distraction device was used (Antão™, Portugal), allowing the insertion of 4 pins.
A clinical evaluation of each patient was made and we asked them to estimate the improvement of the functional and aesthetic skills of the lengthened fingers in a linear scale of 0 to 10. One of the patients was unable to do that due to his youth.
We consider a good functional recovery when a patient score equal or higher than 5 in a linear scale of 0 to 10 was obtained, and a good aesthetic recovery for a patient score equal or higher than 5 in a linear scale of 0 to 10.

Results

Nine patients were male ($p < 0.001$). The mean age observed was 26.4 ± 18.9 years-old (mean $\pm$ standard deviation), without difference for sex, with a maximum value of 57 years-old and a minimum of seven years-old.
We lengthened five fingers of the first ray (38.4%), four (30.8%) of the second ray, and four (30.8%) related to other rays of the hand. In two patients we made distraction lengthening of several rays simultaneously. Most of the distracted rays, nine (69.2%), where on left side.
The mean lengthening achieved was 28.2 ± 5.7 millimetres, with a maximum value of 35 millimetres and a minimum of 13 millimetres.
For the functional evaluation the mean value obtained was 6.3 ± 2.8, with a maximum value of nine and a minimum of one in the referred linear scale. 72.8% of the cases where considered has good functional recovery.
For the aesthetical evaluation the mean value obtained was 4.7 ± 1.7, with a maximum value of seven and a minimum of one in the referred linear scale. 27.3% of the cases where considered has good aesthetical recovery.
After a mean follow-up of 25.8 ± 14.0 months we found two complications with one case of fracture of the callus bone (the patient request the removal of the distraction hardware previously to our usual period for bone consolidation), and one case of premature consolidation (in a young patient, probably because of lack of correct adjustments of the hardware).