Minimally Invasive combined Distal Metatarsal and Akin Osteotomies for Concomitant Metatarsophalangeal and Interphalangeal Hallux Valgus

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INTRODUCTION:

Hallux Valgus (HV) is a complex forefoot deformity characterized by a lateral displacement of the first toe, and a medial displacement and pronation of the first metatarsal bone. In some cases, HV can be the result of a concomitant deformity affecting both the HV MetaTarsoPhalangeal (MTP) and InterPhalangeal (IP) joints. In such conditions a metatarsal osteotomy alone may be insufficient for the correction: as a matter of fact, combined osteotomies have been shown the potential to provide better results, with improved radiological outcomes and lower recurrence rates. However, there is currently a scarcity of medium- to long-term follow-up studies.

The aim of this study is to report the clinical and radiological outcomes of the minimally invasive Simple Effective Rapid Inexpensive (S.E.R.I.) distal metatarsal osteotomy combined with Akin osteotomy for correcting concomitant metatarsophalangeal (MTP) and IP HV deformity with a minimum follow-up of 48 months.

METHODS:

This retrospective observational study included consecutive patients with concomitant MTP and IP HV deformity who underwent S.E.R.I. distal metatarsal osteotomy and proximal first phalanx Akin osteotomy from January 2015 to April 2021. Ethical approval was obtained from all the participants.

Osteotomies were performed by medial approaches through a double 1cm incision. A single 2 mm K-wire was inserted in a proximal to distal direction through the metatarsal incision into the soft tissues adjacent to the bone along the longitudinal axis of the great toe, coming out at 5 millimeters from the nail. A grooved lever was used to laterally displace the metatarsal head relative to the metatarsal diaphysis. The K-wire was then inserted in a retrograde fashion, from distal to proximal, into the first metatarsal diaphyseal channel, indirectly closing the osteotomy at the phalangeal level.

Patients were followed for at least 48 months with pre- and postoperative weight-bearing dorso-plantar and lateral radiographic views.

All complications were recorded.

Clinical evaluation involved the Manchester Oxford Foot Questionnaire (MOXFQ), the EuroQol questionnaire (EQ-5D-5L), and the Visual Analogue Scale for pain (VAS-Pain). Radiological evaluation measured the Hallux Valgus Angle (HVA), InterPhalangeal Angle (IPA), the first InterMetatarsal Angle (IMA), and the Distal Metatarsal Articular Angle (DMAA).

The data's normal distribution was evaluated using the Shapiro-Wilk test. Descriptive statistics were reported as mean ± standard deviation. Paired t-tests were used to compare pre- and postoperative radiographic measurements. Categorical data were summarized using descriptive statistics.

RESULTS:

Between January 2015 and April 2021, 51 feet from 43 patients (37 women, 6 men) with concomitant MTP and IP HV deformity (HVA > 15°, IPA > 10°) underwent combined S.E.R.I. distal metatarsal and Akin osteotomies. The mean age was 51.3 ± 16.0 years, and the mean follow-up was 39.2 ± 2.6 months (range 36-51 months). Associated surgical procedures, mostly lateral toes deformity corrections, were performed in 21 patients. Post-operative complications were limited to wound disorders that healed without sequelae.

No case of non-union was observed. Three cases of postoperative residual HV deformity (HVA = 15.2°, 15.4° and 16°) were observed at 48 months, with only the latter being a case of HV radiographic recurrence according to the method described by Kilmartin et al.

Clinical and radiological results demonstrated statistically significant improvements. The MOXFQ scores decreased from 28.2 ± 10.7 to 5.68 ± 4.41, the EQ-5D-5L scores improved from 0.59 ± 0.21 to 0.92 ± 0.13, and the VAS-Pain scores were reduced from 4.48 ± 1.35 to 0.66 ± 1.04.

Radiologically, the IMA decreased from 12.4 ± 2.98 to 4.6 ± 1.91, the HVA was reduced from 33.4° ± 9.71 to 7.51° ± 3.21, the DMAA improved from 26.5° ± 10.7 to 8.29° ± 4.6, and the IPA decreased from 19.1° to 7.39°.

DISCUSSION AND CONCLUSION:

This study reported good medium terms results, and a very low rate of radiological recurrence after combined S.E.R.I. and Akin osteotomies for concomitant MTP and IP HV.

These outcomes may be attributed to the high versatility of this combined surgical technique: correction of first ray pronation was achieved through the rotation applied to the linear distal metatarsal osteotomy, and the medial shift of the extensor hallucis longus tendon insertion was accomplished with the Akin osteotomy, reducing its abductor function.

The metatarsal osteotomy fixation using a single K-wire has already been proven effective: this combined technique aims to address the drawbacks of fixation devices and hardware intolerance while reducing costs and surgical time. Additionally, the compressive action of the K-wire on the proximal phalanx's medial side, along with a wedge-shaped medial osteotomy that preserves the lateral cortex, likely enhances correction stability.
Despite the reported good results, future studies should focus on identifying specific patient groups that could benefit the most from these combined surgical techniques, which could potentially lead to an extension of their surgical indications.