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A novel modification of the Stainsby procedure: Surgical technique and clinical outcome

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ABSTRACT

Background: The 'Stainsby procedure' is an effective salvage procedure for correction of fixed claw toe deformity. A novel approach is described involving the extensor tenotomy step of the procedure, which is easier, faster and safer to perform.
Methods: A retrospective single surgeon review was performed to assess this modification. 37 patients (92 lesser toes in 42 feet) underwent the modified Stainsby procedure. Mean follow-up was 17 months. Patients were interviewed and examined at a dedicated review clinic. American Orthopaedic Foot and Ankle Society (AOFAS) forefoot scores and Foot and Ankle Outcome (FAO) scores were calculated.
Results: Significant improvements in end-points including metatarsalgia, callosity and requirement for insoles or chiropody were noted. Median AOFAS and FAOS scores following the modified Stainsby procedure are reported and compare favourably to previously reported scores. Median FAOS scores were as follows: 92 for the category of pain, 84 for symptoms and stiffness, 96 for activities of daily living, 100 for sports and recreation and 81 for quality of life. Median AOFAS forefoot score was 80. There was a low rate of wound infection of 2.7% ($n = 1$).
Conclusion: We describe a novel technical modification to the Stainsby procedure and our results support the use of this modification, following assessment of patient outcome. However, limitations to this study were noted in terms of the length of follow-up, the absence of pre-operative clinical scores for comparative purposes, and the variety of surgical procedures performed concomitantly on the 1st ray.

1. Introduction

The Stainsby procedure is a salvage procedure for fixed subluxed or dislocated lesser toe metatarsophalangeal joints with fixed claw deformity. Stainsby identified important anatomical considerations relating to forefoot deformity and its reconstruction [1]. Using anatomical and radiological studies he described dorsal displacement of the plantar plate in severe lesser toe clawing which drives a 'plunger' effect of the metatarsal heads, via its attachments to the transverse and longitudinal ligamentous tie-bar systems. This results in forefoot deformity, metatarsalgia and callosity formation. Callosity occurs at both the plantar aspect of foot underlying the metatarsal heads and dorsally over the inter-phalangeal joints causing pain and limiting footwear due to dorsal impingement. The metatarsal heads are an essential component of the weight-bearing forefoot and ligamentous tie-bar systems [2] and should therefore be preserved during surgical correction of severe forefoot deformity.

The Stainsby procedure involves returning the plantar plate and fat pad back to their normal anatomical position underneath the metatarsal heads. The first results from this procedure were published in 2001 [3]. These early results demonstrated 81% of those who underwent the Stainsby procedure on multiple lesser toes were asymptomatic at a mean follow-up of 5 years. Subsequent studies [4–7] demonstrated the efficacy of the Stainsby procedure in the correction of claw deformity thereby eliminating or improving associated metatarsalgia and callosity.

The original description of the Stainsby procedure involves the following steps, as illustrated in Diagrams 1 and 2: an angled dorsal incision is made over the metatarsophalangeal joint of the affected phalanx. The angle of this incision is broad (approximately 150°) and laterally based, extending from the proximal interphalangeal joint to the proximal aspect of the metatarsophalangeal joint. It is deepened directly to the extensor tendons to maximise the

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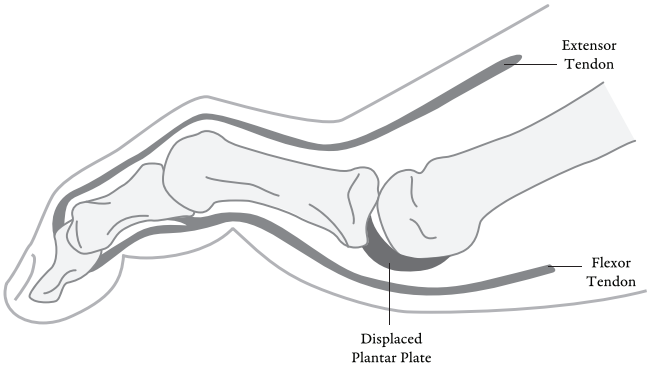

Diagram 1. Schematic diagram of lesser toe pre-op Stainsby procedure.

vascularity and viability of skin bridges, particularly when operating on multiple digits.

Through this the extensor tendon is identified, divided at the metatarsal neck and reflected distally. The proximal phalanx is divided through its neck and the proximal portion is excised, removing approximately one third of the entire proximal phalanx (Fig. 1). The plantar plate and forefoot fat-pad can then be accessed at which point they are freed from the dorsal aspect of the metatarsal head and repositioned underneath it. This realigns the lesser toes into their correct position. At this point the distal stump of the extensor tendon is sutured loosely, through the phalangeal resection, down to the flexor tendon using an absorbable suture (in our case a 2-0 vicryl suture is used). Although not universally performed [8,9], this step aims to prevent reattachment of the extensor mechanism with subsequent recurrence of claw deformity and to provide additional stability. The newly realigned resected proximal phalanx stump and metatarsal head are then stabilised with an intramedullary wire (Fig. 4).

The modified procedure in this study was performed using all of the steps of the original Stainsby procedure described above except for the final extensor tenodesis step. In the current modification, the extensor tendon is simply passed between the metatarsal head and the stump of the proximal phalanx and sutured straight through to the plantar aspect of the foot using an absorbable suture (2-0 Vicryl) as illustrated in Diagram 3 and Figs. 2 and 3. This transcutaneous suture is then tied off at the plantar aspect of the foot in a single knot prior to k-wire stabilisation of the metatarsal to the proximal phalanx. This knot is eventually cut flush with the skin between 4 and 6 weeks post-operatively along with removal of the intramedullary wires, pending clinical progress and taking into account patient specific wound and bone healing capacities in addition to the estimated stability of the soft tissue repair.

This modification is technically easier and faster to perform than the original Stainsby procedure. There is a potential reduction

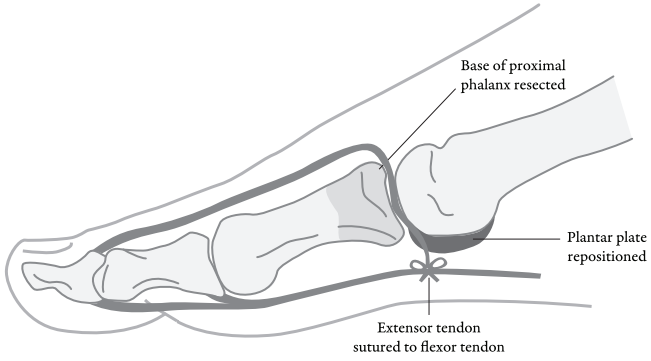

Diagram 2. The original Stainsby procedure.

Fig. 1. Resection of proximal portion of proximal phalanx via angled dorsal incision.

in neurovascular complications when performing this modified procedure as there are fewer needle passes required to complete the extensor tenodesis step in the small space between the metatarsal head and resected proximal phalanx. Therefore it is theoretically safer than the original description whereby extensor to flexor tenodesis is performed in the small gap left following the proximal phalangeal resection.

Pre and post-operative radiographs demonstrate correction of claw-toe deformity as carried out using our modification of the Stainsby procedure in Fig. 5.

The aim of this study was to assess the efficacy of a modified Stainsby procedure in the correction of claw toe deformity and in resolution of associated metatarsalgia and callosity. A secondary aim was to determine patient satisfaction with this modified procedure.

2. Methods

A retrospective, single surgeon, single institution review of a 4 year period (March 2008–2012) was performed.

Theatre log-books were reviewed to identify the number of modified Stainsby procedures performed and patient demographics. A detailed chart review of these patients was then carried out to confirm the Stainsby procedure had been performed with the modification described in the present study. The patient history was reviewed in terms of the indication for surgery, previous foot surgery and documented complications at outpatient follow-up.

Patients identified from the theatre log book and chart review were invited to attend a dedicated review clinic for interview, examination and calculation of standardised Foot and Ankle Outcome (FAO) scores and American Orthopaedic foot and ankle

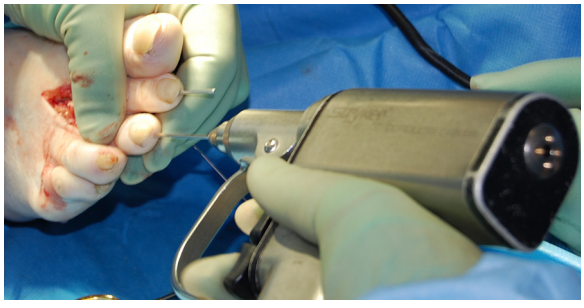

Fig. 2. Intramedullary wire through distal phalanx and remaining portion of proximal phalanx.