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Subjective versus objective assessment in early clinical outcome of modified Lapidus procedure for hallux valgus deformity

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ABSTRACT

Background: Studies have assessed the outcome of hallux valgus surgeries based on subjective questionnaires, usually the American Orthopaedic Foot and Ankle Society Score, and radiographic results reporting good to excellent outcome at 6–12 months postoperatively. However, contrasting results were reported by gait studies at 12–24 months postoperatively. In a previous study, we found nine gait parameters which can describe the altered gait in hallux valgus deformity. This study aimed, to assess the outcome of modified Lapidus at 6 months postoperatively, using gait assessment method, to determine if the nine specified gait parameters effectively relates with the clinical scores and the radiological results or add information missed by these commonly used clinical assessments.

Method: We assessed 21 participants including 11 controls and 10 patients with moderate to severe hallux valgus deformity. The patient group was followed 6 months postoperatively. The ambulatory gait assessment was performed utilizing pressure insoles and inertial sensors. Clinical assessment includes foot and ankle questionnaires along with radiographic results. Comparison was made using non parametric tests, $P < 0.05$.

Findings: Altered gait patterns, similar to the preoperative outcome, persisted at 6 months postoperatively when compared to controls. The foot and ankle ability measure score showed an outcome comparable to the gait results. In contrast, the American Orthopaedic Foot and Ankle Society Score and radiographic results showed significant improvement.

Interpretation: Study supports the reliability of nine defined gait parameters in assessing the outcome of hallux valgus surgeries. The existing clinical assessment overestimates the functional outcome at the early postoperative phase.

1. Introduction

Hallux valgus (HV) is one of the most commonly seen orthopedic conditions in clinical practice with an estimated prevalence of 23% to 35.7% (Nix et al., 2010). Several surgical options are available based on the severity of the deformity (Lin and Bustillo, 2007; Robinson and Limbers, 2005). At present, the clinical assessment of the outcome of these surgeries is based on radiographic presentation and subjective questionnaires, mainly the American Orthopaedic Foot and Ankle Society Score (AOFAS) — forefoot (Adam et al., 2011; Coetzee and Wickum, 2004; Dennis and Das De, 2011; Kerr et al., 2010; Kopp et al., 2005; Schuh et al., 2008). However, radiographic images do not take the dynamic loading into account and the reliability of subjective questionnaires has come into question in the last decade (Baumhauer et al., 2006; Button and Pinney, 2004; Guyton, 2001; Parker et al., 2003; SooHoo et al., 2003). According to the cited studies, the AOFAS score has consistently shown an average score of greater than 80 already at 6 months postoperatively (Coetzee and Wickum, 2004; Dennis and Das De, 2011; Kerr et al., 2010; Kopp et al., 2005; Schuh et al., 2008) which could be met with skepticism. Also, regarding HV deformity (Canseco et al., 2010; Chopra et al., 2015; Deschamps et al., 2010; Galica et al., 2013; Wen et al., 2012) and its surgical correction (Bryant et al., 2005; Cancilleri et al., 2008; Dhukaram et al., 2006; Schuh et al., 2010), not many studies have looked upon the complete biomechanical profile of the foot and not much information is available regarding the foot mechanics postoperatively. Furthermore, no clinical study so far has looked upon the outcome of modified Lapidus correction prospectively based on gait assessment.

In recent years, objective gait assessment has left its mark in understanding the biomechanics of the foot and ankle in various foot pathologies and in assessing the functional outcome of the surgeries (Chopra et al., 2014; Khazzam et al., 2007; Turner et al., 2003). Objective gait assessment takes into account dynamic loading, functional progress and

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existing gait impairments. This information could improve rehabilitation with early detection of abnormal gait parameters (Coutts, 1999; Schuh et al., 2009). The new generation gait assessment methods are also portable, affordable and easy to use (Lambrecht and Kirsch, 2014; Razak et al., 2012).

In our previous study (Chopra et al., 2015), nine gait parameters were found which can best describe the altered gait in moderate to severe HV deformity. These nine parameters also showed fair to good correlation with AOFAS and Foot and Ankle Ability Measure (FAAM) score respectively. The aim of the current study was to objectively assess the early outcome of the modified Lapidus procedure for correction of moderate to severe HV deformity at 6 months postoperatively based on subjective questionnaires, radiographic presentations and functional gait assessment. Postoperative follow-up of 6 months was chosen over three months or 12 months because the former is too early for full weight bearing and the latter is long after the peak recovery phase and also because studies have shown good recovery around 6 months postoperatively for HV surgery (Kerr et al., 2010; Schuh et al., 2008, 2009). Another important reason behind choosing the 6 months postoperative period is that, by this time physiotherapy sessions are finished and, in general, the compliance to exercise at home has been shown to decline gradually due to several factors including motivation (Campbell et al., 2001) and hence it is a crucial time to assess the prognosis. The working hypothesis of the study is that gait assessment should show comparable results to the other utilized assessment methods.

2. Materials and methods

2.1. Participants

Ten females patients with moderate to severe HV deformity (mean age 51.3 (10.3) years, mean BMI 22.9 (3.2) kg/m^2) and eleven healthy female volunteers with no sign of HV deformity (mean age 50.4 (7.1) years, mean BMI 24.3 (3.8) kg/m^2) were compared. All ten patients were consecutive cases which were listed for modified Lapidus correction. The contralateral sides of most patients also had signs of HV but are asymptomatic. All 10 patients underwent 9 sessions of physical rehabilitation, 1 session per week, at 3 months postoperatively. The patients were followed at 6 months postoperatively to monitor the early recovery. Indications for modified Lapidus procedure included moderate to severe HV with insufficiency of the first ray as expressed by marked transfer metatarsalgia, and/or hypertrophy of the second metatarsal, and/or osteoarthrosis of the second tarso-metatarsal joint. Patients were excluded if they were affected by neurologic or other pathologies of the lower extremities or have had previous HV corrective surgery. The control population included volunteers with no prior history of neurological conditions or other pathologies of the foot and ankle or any previous surgeries or trauma of lower limbs which may affect their gait. All participants gave informed consent. Approval of the ethics commission of the University was obtained.

2.2. Operative procedure

Lapidus procedure was performed as a modification of the original technique (Lapidus, 1934). Patients were placed supine and given a third generation cephalosporin prophylaxis. A 300 mmHg tourniquet was inflated at the thigh. Percutaneous lateral release of the first metatarso-phalangeal joint (MTP1) was performed, longitudinally sectioning the capsule just above the lateral sesamoid while keeping the tendon of the adductor hallucis intact. A medial longitudinal incision was then carried out, the MTP1 was exposed and the dorso-medial pseudo-exostosis was removed from the first metatarsal head. Another more proximal incision was performed dorsally to expose the first tarso-metatarsal joint (TMT1) and the joint between the first cuneiform and the base of the second metatarsal. Articular cartilage was removed from these joints using a sharp raspatorium, and then the surfaces were prepared by multiple drilling and microfractures. The first and second metatarsal (M1/M2) angle was reduced and the TMT1 was stabilized with two 3.5 mm cortical lag screws. A third positioning screw was then inserted from medial to lateral between the bases of the first metatarsal and the second metatarsal (Fig. 1). At this point, if a contact between the first and second toes was still present, a basal medial closing wedge osteotomy of the basis of the first phalanx of the hallux was performed (Akin osteotomy) and stabilized, medially, with a transosseous 1.0 Vicryl suture. The MTP1 capsule was then closed with separate 1.0 Vicryl sutures and the skin incisions were closed with separate 3.0 Vicryl Rapid sutures. The dressing was adapted to gently pull the first toe into varus. On postoperative day one the dressing was changed, a removable short leg cast was adapted, and patients were mobilized in 10 kg partial weight bearing for six weeks, followed by six weeks of progressive weight bearing. The cast was removed at three months and physiotherapy was continued for about two months.

2.3. Clinical assessment

Clinical assessment included subjective questionnaires — AOFAS forefoot score and FAAM — activity of daily living (ADL) score and radiographic findings (antero-posterior and lateral load radiographies). Radiographic assessment was performed by a single independent observer, illustrating the M1/M2 angle, hallux valgus angle (HVA) and distal metatarsal articular angle (DMAA) (Chopra et al., 2015). The ADL sub score of FAAM was utilized instead of total FAAM (ADL+ sports), because the sports section of the score was ignored by most of the patients and hence inclusion of total FAAM score could have masked the real outcome. Both clinical and radiographic assessment were performed preoperatively and six months after surgery.

Fig. 1. *Antero-posterior radiographic presentation of modified Lapidus procedure.* After reduction, fixation was achieved using two 3.5 mm lag screws across the first tarso-metatarsal joint and one positioning screw across the bases of the first and second metatarsals.