

A BIPLANE “V” OSTEOTOMY OF THE TROCHANTER IMPROVES STABILITY

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INTRODUCTION

Delayed or nonunion of the greater trochanter can complicate the recovery of a patient from total hip arthroplasty. Although many factors may influence union, stability of the trochanter fragment is essential. The wiring technique is an important factor. Many have been suggested and some have been evaluated mechanically (Markolf et al 1979, Dall, et al, 1983) Clinical studies of osteotomy techniques suggest advantages of the “chevron”, biplane “V” and dihedral configurations over a single planar cut (Berry & Muller, 1993, Weber, 1989). Elghor (1992) failed to demonstrate differences between flat and biplane osteotomies stabilized with either the Charnley wire configuration, a spring-wire system of Dall-Miles cable grip.

We hypothesized that the biplane “V” osteotomy would result in a more stable structure when loads were applied that simulated muscle force applied to the trochanter at the beginning of rising from a chair.

MATERIALS AND METHODS

Urethane models of a proximal femur prepared for total hip arthroplasty were used to ensure consistency between specimens. A single plane trochanteric osteotomy, 45° to

the long axis of the femur, was made in 8 models. A biplane “V” osteotomy was made in another 8 models. A cutting jig was used to ensure consistency of osteotomy location. A second jig was used to drill holes for wire passage and for attachment of the loading cable to the trochanter fragment. The trochanter was stabilized using the Charnley wiring technique (2 vertical and 2 looped horizontal wires) using 18 gauge orthopaedic wire. The repaired model was mounted in a stabilizing frame so that the load was applied at 90° to the osteotomy (simulating gluteal loading while rising from a chair). Load was applied by pulling on the cable attached to the trochanter using a materials testing machine (Instron 1122, Canton, MA), at a loading rate of 200 mm/min, until failure of the wire was observed or the fragment had displaced greater than 10 mm. Displacement of the trochanter was measured with an extensometer attached to the femoral shaft and resting on the caudolateral aspect of the trochanter. The osteotomies were compared based on load and stiffness at 1 and 5 mm of displacement using a Student t-test ($p < 0.05$).

RESULTS

The biplane “V” osteotomy was significantly stronger and stiffer at both displacements than the planar osteotomy (Figures 1 & 2).

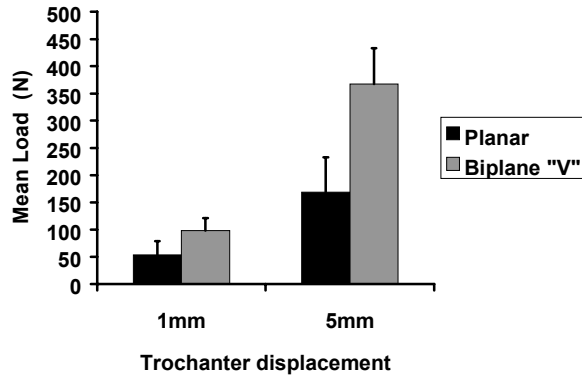


Figure 1. Mean load required to displace the trochanter 1 and 5 mm for planar or biplane “V” osteotomy

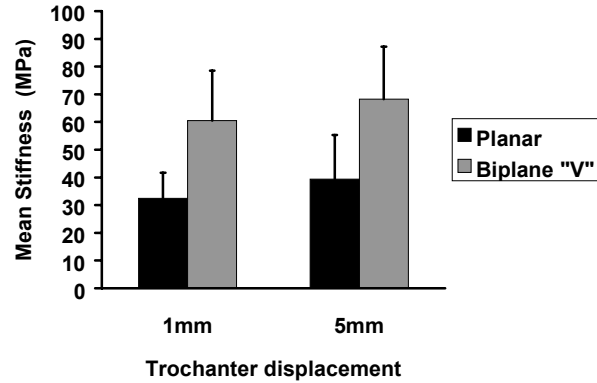


Figure 2. Mean stiffness of the repaired planar and biplane “V” osteotomies at 1 and 5 mm of displacement

DISCUSSION

When the direction of gluteal pull is forward of the line of the femur, the trochanter fragment tends to rotate. For the planar osteotomy, the wire configuration was not effective in limiting trochanter movement. For the biplane “V” osteotomy, the interlock of the trochanter in the osteotomy bed effectively countered rotation. The fragment could only move from the bed by rising upwards, and the wire configuration was effective in limiting displacement in that direction.

Of concern is the observation that, even given the ideal model, for both osteotomy configurations, the load that caused 1 mm of displacement is much lower than the predicted loads for this muscle group during many normal activities.

This study shows that a biplanar “V” osteotomy is more stable when gluteal

loading from multiple directions is considered. Stabilization techniques that result in a stiffer repair are likely to improve clinical results.

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