INTRODUCTION:
Treatment of diaphyseal tibia fractures with intramedullary (IM) tibial nailing is widely accepted and has been expanded to distal metaphyseal fractures. Newer generation tibial nails provide several distal interlocking screw options. The objectives of this study were: 1) to determine if the new distal oblique interlocking option provides superior stability, 2) to determine which screw orientation or configuration is the most biomechanically stable for the IM nailing of distal tibia fractures, and 3) to determine if three distal interlocking screws provide any advantage in comparison to two distal interlocking screws. The null hypotheses were: 1) two distal locking screws, one medial to lateral and one oblique orientation, will provide equal stability when compared to the other interlocking screw configurations, and 2) three distal locking screws will provide as much stability as two distal locking screws implanted in the proper configuration.

METHODS:
A preliminary experiment was performed with four different screw configurations: (I) one medial-to-lateral and one oblique, (II) two medial-to-lateral, (III) one medial-to-lateral and one anterior-to-posterior, and (IV) one medial-to-lateral, one anterior-to-posterior and one oblique in simulated distal tibiae with a simulated distal metaphyseal fracture (Fig. 1). A total of twenty-four Synthes EXPERT tibial IM nails (10.0 mm diameter, 330 mm length) were used for six specimens of each screw configuration. For Part I, tibial IM nails were distally locked with either two or three 5.0 mm interlocking screws into simulated distal tibiae consisting of PVC pipe (OD: 25.0 mm with ID: 17.0 mm). For Part II, the two most stable configurations (from Part I) were tested using a simulated distal cadaveric tibiae metaphyseal fracture. Five pairs of cadaveric distal tibiae were used for each screw configuration tested. Data retrieved from compression loading, anterior-posterior bending, medial-lateral bending, and rotation torque tests were analyzed with analysis of variance (ANOVA: Single-factor, Microsoft Excel) with an alpha level of 0.05. These analyses were used to compare the difference in each screw configuration/orientation of distal locking screws in distal metaphyseal tibia fractures and each testing mode between constructs in terms of stability.

RESULTS:
Table 1 shows the comparison of the construct stability properties between the four different screw configurations. There were significant differences (p < 0.05) in stability between the four screw configurations (Table 2). Configurations II and IV were found to be more stable than the other two configurations. Statistically, no significant difference was detected in construct stability in all modes of testing between Configurations II and IV (Table 3).

DISCUSSION:
The results of this study revealed that there were significant differences in construct stability between all four distal screw configurations for distal tibia fracture fixation using IM nailing. The new distal oblique interlocking option (Configuration I) did not provide superior stability for the fixation of the distal tibia fracture. However, the new distal oblique interlocking option (Configurations I and IV) did increase the torsional stiffness and strength, as was predicted. Only a relatively small number of cadaveric samples were included in this study. The changes in the construct stability properties between two distal interlocking screws (Configuration II) and three distal interlocking screws (Configuration IV) were extremely small and statistically there was no significant difference (Table 3); therefore, we are confident that two medial to lateral distal interlocking screws (Configuration II) and three distal interlocking screws (Configuration IV) provide equivalent construct stability. When choosing IM fixation for treatment of distal tibia metaphyseal fractures two medio-lateral screws and/or an oblique screw may be economically advantageous compared to three distal locking screws and/or an oblique screw.