A Biomechanical Study of Scaphoid Headless Screws

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ABSTRACT

Scaphoid fractures are the most common fracture of the carpal [1]. Headless screws are favored for internal fixation in the treatment of displaced or unstable fractures. Compression plays the most important role in fracture stability, maintaining gap reduction and also accelerating the healing of cancellous bone [2]. This study compared the generated compression force andfastening torque and the effect of pre-drilling on them during insertion of five frequently used headless compression screws. In this study solid rigid polyurethane foam was used as a substitution to human cancellous bone to achieve more consistent statistical results. Pre-drilling did not have a significant effect on the average maximum generated compression, although it significantly increased the fastening torque. Mini-Acutrak 2 generated the maximum compression and showed the most reliability and sustainability of the generated compression and no risk of being compromised due to over-fastening was observed. Twinfix had the second highest generated compression, 31% more than Kompressor Mini. However, it showed a higher risk of losing compression.

RESULTS

Pre-drilling Method:

• Force
  • Mini-Acutrak 2 (Acumed®)
  • Max. Compression of 45.4 N
  • No significant effect of pre-drilling on compression force
  • No over-fastening effect

• Torque
  • With pre-drilling
  • Max. Compression of 70 N
  • 0 revolutions
  • Without pre-drilling
  • Max. Compression of 13.4 N
  • 1 revolution

Herbert-Whipple (Zimmer®)

• Max. compression of 13.4 N
• Self-cutting did not work well without pre-drilling

Twinfix (Stryker®)

• Max. compression of 45.4 N
• No over-fastening effect

Kompressor Mini

• A profile similar to Twinfix
• Max. compression of 20.8 N
• Torque can be misleading for the surgeon

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REFERENCES