عنوان مقاله:

Feasibility Analysis of a Novel Method for the Estimation of Local Bone Mechanical Properties: A Preliminary Investigation of Different Pressure Rod Designs on Synthetic Cancellous Bone Models

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خلاصه مقاله:

Background: Whilst traumatology around elderly population becomes more and more popular nowadays, the knowledge of local bone quality prior to osteosynthesis is of paramount importance. Assessment of the local bone mechanical properties provides essential information related to implant stability and can support treatment strategies in a timely manner. In the acute setting, dual-energy X-ray absorptiometry and quantitative computer tomography cannot be used routinely, and up till now no known intraoperative methods have been established. Methods: A novel technique was developed to determine the local bone strength. A feasibility and sensitivity analysis were performed on synthetic cancellous bone models of various densities [including osteoporotic ranges (۰.۱۲ - ۰.۴۸g/ cm۳)] by testing the permeability of different rod probe designs. Results: The Intraoperative Osseomechanical Strength Measurement (IOSM) method revealed high sensitivity for the evaluation of local density on synthetic bone material. Among the indenter designs tested, the one with ۴۰° sharp apex and ۵ mm diameter reflected accurately the density changes of the synthetic bones. It was also associated with less invasiveness posing no risk for the primary implant stability of the osteosynthesis that may follow. Conclusion: The IOSM method using the indicated indenter design on synthetic cancellous models appears to be a minimal invasive technique with high accuracy in identifying different bone densities . Further studies on human bone material are now focused on the evaluation of the IOSM sensitivity compared to the gold standards (Dual-energy X-ray absorptiometry and quantitative computer tomography). Level of evidence: V

کلمات کلیدی:

Bone mineral density, implant failure, intraoperative evaluation, local bone strength, osteoporotic fracture, Osteosynthesis