Reducing Radiation Exposure in Intra-Medullary Nailing Procedures: Intra-Medullary Endo-Transilluminating Device

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Introduction: Intra-medullary nailing has been the most commonly used technique when treating patients with lower limbs fractures. During the operation, a crucial but tedious step is to locate the distal interlocking screw holes. This procedure has been performed either using fluoroscopy or with the aid of a specially designed target-aiming device (TAD). The main problem with the fluoroscopic approach, besides its relatively higher operation cost, is the radiation exposure to the patients and to the surgical team. Since the TAD is often impaired by the fact that nail deformation is commonly encountered during insertion, which made repeated drillings with trial and error. Thus, the fluoroscopic method remains the most popular approach to date. The purpose of this study was to develop a fluoroscopy-free technique that would aid the positioning of intra-medullary interlocking screws.

Materials and Methods: We developed an intra-medullary endo-transilluminating device that was able to aid distal interlocking. By directing a light source with a small light-emitting diode (LED), inside the bone cavity near a targeted screw hole, a portion of the light is able to penetrate through the hole and the outer bone surface. It can then be detected in situ and in real time by an external observer with naked eyes. A total of 19 consecutive tibia-fracture patients were recruited for the study. All fractures were stabilized with intra-medullary nails. In all cases, evaluation was carried out based on the failure rate and operation times. Failure rate is defined as the number of repeated drilling attempts divided by number of cases.

Results: Among the 19 tibia-fracture patients for this study, no repetition of the drilling procedure or insertion of a transverse interlocking screw was needed. Thus the failure rate was 0% (0/19). The average time to finish the insertion of one distal interlocking screw was 4.1±1.8 min without fluoroscopy usage.

Discussion: The non-fluoroscopic approach thus decreases the health hazards that the patients are experiencing as well as those of the surgical team who need to perform such intra-medullary nailing operations on a routine basis. The proposed endo-transilluminating method allows prompt, accurate and reduced radiation exposure during intra-medullary nailing procedures.