Introduction

The locking nail concept ("Detensor") was introduced by Küntzsch1 in 1968 and developed further in the early 1970s.2,3 Several authors have reported good results on the concept of dynamic fracture fixation using the locking nail.2-8 While introduction of the proximal locking screw is technically easy, the torsion of the locking nail being driven into the medullary canal can make distal locking more difficult.5,8 There are two approaches to the insertion of the distal screws: the C-arm mounted device2-7 and the freehand technique.3,8,9 The locking nail has worked well in our service since 1977. The Grosse-Kempf C-arm device was introduced in 1979, but it requires a modification of the fluoroscopy unit and is time consuming. The freehand technique bears certain disadvantages because of involuntary movement during the change from aiming to drilling. Furthermore, the bulky power-drill makes monitoring of the path of the drill bit impossible, and radiation time can be considerable.9

A new, freehand distal aiming device for the locking nail was, therefore, designed (Fig. 1). The main objectives were to provide a simple, yet precise instrument with few parts that allows monitoring of the direction during the nail hole penetration process. The device consists of two metal rings on both ends of a radiographic translucent cylinder with a central 4 mm hole. A pin with a sharp tip (diameter 4 mm, length 160 mm) is inserted through the hole. The C-arm is moved until perfect alignment of the screw hole and camera axis has been reached and the locking nail hole appears as a circle on the screen.5,10 The tip of the pin is then put onto the skin so that it is within the circle on the screen. A stab incision is made and the soft tissue is divided to the bone using scissors. Using the image intensifier, the device is then placed so that the sharp tip of the pin points to the bone (Figs. 2-3). The device is moved until the two metal rings are superimposed on each other and give the impression of one ring with the nail hole in the middle (Fig. 4). On the screen, the pin then appears as a dot inside the nail hole (Fig. 4). The pin is now driven through the lateral cortex and the hole in the nail until it reaches the opposite cortex (Fig. 5). Only very short radiation time is required for this procedure. The Steinmann pin is then pulled out, and the 4 mm hole is widened with a 4.5 mm drill bit for both cortices and with a 6 mm drill bit for the lateral cortex (Fig. 6). The appropriate screw can now be inserted. After this procedure has been repeated for the second hole, the distal locking is completed (Fig. 7). A final image intensifier check in

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Fig. 1: Prototype of the distal aiming device designed at the authors' workshops (top) and sharp tip device previously used (bottom) (A). Device is now commercially available (Howmedica, Rutherford, NJ) (B and C).

Fig. 1A.

Fig. 1B.

Fig. 1C.

Fig. 2: The tip of the pin on the outer cortex of the femur.

Fig. 3: The head of the device brought into the beam. Note the two rings.

Fig. 4: When the two rings are superimposed, the pin is within the nail hole axis and can be driven through the lateral cortex, the holes, and into the medial cortex of the femur.

Fig. 5: The AP view shows the correct pin placement. Note that the medial cortex is not penetrated.

Fig. 6: Widening of the 4 mm pin hole with the appropriate drill bits. The views shown in Figures 5 and 6 are not required in clinical practice.
both planes is made in the end.

Studies of radiation doses were carried out using a hand-held dosimeter (Babyline 61, Nardex-Loches, France). A sharp tip conventional aiming device, as previously used in our department (Fig. 1), was compared to the new device described here. With equal radiation time, exposure rates at the surgeon’s hand showed a reduction of 80% when using the new device. A further reduction of 75% can be achieved when using a reduced beam (Table). To reach the maximum dose at the hand for 3 months (18750 mrad), 22,455 distal locking procedures (30 seconds radiation time per procedure, broad beam) could be carried out with the new device. The exposure rate behind the protective apron (0.25 mm lead equivalent) showed no radiation above ground.

With the two metal rings, correct placement of the pin before and during the bone-nail hole penetration process is not difficult. A further advantage of this device is that the path of the Steinmann pin can be monitored with the image intensifier at any time during the procedure. The flexibility of the pin makes the penetration of the nail hole possible even if the tip of the pin is not precisely in the center of the circle. In 70 distal locking procedures (Grosse-Kempf nails, Howmedica, Rutherford, NJ) carried out with the prototype of this device, we did not observe a single miss. Even in distal fractures, we did not encounter a fissure or fracture caused by driving in the Steinmann type pin. The average time for the insertion of the distal locking screws was 12 minutes with a radiation time of less than 30 seconds per procedure. The device can be used for both the femoral and the tibial locking nail.

References


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