TresLock for Unstable Proximal Femoral Fractures: Morphological Compatibility and Clinical Results: A Case Series

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Learning Point of the Article:
TresLock is a new device and shows good anatomical compatibility for femurs.

Abstract

Introduction: A new device, TresLock (KISCO DIR Co., Ltd., Kobe), has been used for the treatment of unstable proximal femoral fractures and was designed based on Japanese anatomical characteristics. It has three sliding hip screws with one side plate. The angle of all screws relative to the plate has been set to 128°, and each hip screw has a short thread (15 mm) to prevent crossing of the fracture line. In this study, we evaluated the morphological compatibility of TresLock.

Methods: We treated 10 patients with hip fractures using TresLock at our institution between September 2016 and December 2017. The average age of the patients was 83.8 years (range, 73–93 years). Fractures included five proximal neck transcervical shear fractures (Orthopaedic Trauma Association [OTA] type-31B2.3, Pauwels III) and five bascervical fractures (OTA type-31B3). The clinical course and three-dimensional computed tomography were evaluated postoperatively.

Results: In all cases, all three screws were inserted within the femoral neck. The screws were inserted at an axis of 2.5 ± 1.3° varus to the femoral neck axis. The distance from the subcapital line to the three (proximal-anterior, proximal-posterior, and distal) screw thread ends was 12.0 ± 1.8 mm, 10.4 ± 2.4 mm, and 11.6 ± 4.0 mm, respectively and was sufficient to actuate compression force. However, one case (Pauwels III) required reoperation because of non-union.

Conclusion: Careful follow-up is needed, but TresLock shows good anatomical compatibility for femurs among the Japanese population.

Keywords: Proximal femoral fracture, bascervical fracture, internal fixation device.

Introduction

There are many options when surgically treating proximal femoral fractures, such as cannulated cancellous hip screws [1] or Hansson pins [2]. However, secondary displacement of the femoral head can occur postoperatively, especially in cases of unstable fractures. Recently, some implants, like the dual SC screw system (KISCO DIR Co., Ltd., Kobe), have a side plate to provide varus-resistant properties [3]. This implant is suitable for simple femoral neck fractures but does not provide sufficient stability for unstable fractures, including proximal neck transcervical shear fractures (Orthopaedic Trauma Association [OTA] type-31B2.3, Pauwels III) and bascervical fractures (OTA type-31B3). Although the treatment for these fractures is difficult and a gold-standard method has not been determined, a multiple-screw fixation within the limited femoral neck space is essential. However, there is no existing device that is designed based on morphological characteristics of the femoral neck.

A new device, TresLock (KISCO DIR Co., Ltd., Kobe), was used for the treatment of unstable proximal femoral fractures. Nakanishi et al. examined the morphology of the proximal femur.
We hypothesized that TresLock had good compatibility because it was designed based on the anatomical characteristics of the Japanese population. This study aims to investigate this hypothesis by measuring post-operative three-dimensional CT imaging results.

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Description of device

TresLock has three sliding hip screws with a side plate and their angle relative to the plate is set as 128°. The arrangement of hip screws is asymmetric, with proximal-anterior, proximal-posterior, and distal positions. The offset of the proximal-anterior screw was larger than the proximal-posterior screw to fit the medullary canal shape of the femoral neck. In addition, each hip screw had a short thread (15 mm) to prevent crossing the fracture line (Fig. 1).

Materials and Methods

Between September 2016 and December 2017, 10 hip fractures in 10 patients were treated using TresLock in our institution. The patients included eight women and two men. The average age of the patients was 83.9 years (range, 73–93 years). Fractures included five proximal neck transcervical shear fractures (OTA type-31B2.3, Pauwels III) and five basicervical fractures (OTA type-31B3). Informed consent was obtained from all patients who participated in this study.

Operation procedures

After achieving reduction as anatomically as possible on the traction table, a distal guide pin was inserted just above the calcar femorale and a proximal posterior guide pin was inserted using the angle-guide device (Fig. 2a). The pins were advanced to just under the subchondral bone. By measuring the length of the two guide pins, the size of the TresLock plate (side plate attached to the distal screw) and proximal posterior screw was selected. After reaming, the distal hip screw along with the side plate was inserted (Fig. 2b). Care was taken to set the plate parallel to the femoral shaft, and guide wires for the proximal posterior and proximal anterior screws were inserted through sleeves fixed on the plate. After insertion of the hip screws, two distal locking cortical screws were inserted to fix the plate on the femoral shaft.

CT evaluation

A continuous full femoral bone CT scan was obtained in each patient using the Toshiba Aquilion ONE/Vision edition (Toshiba Medical Systems, Tochigi, Japan) with a slice thickness of 1 mm. Data were imported into picture archiving and communication system software (G7E Medical Systems).
2. Angle between screw axis and femoral neck axis

The detailed measurement results are shown in Table 1. In all cases, no screws were observed protruding from the femoral neck cortex and all three screws conformed to the femoral neck cross section (Fig. 4). The screw axis was set at 2.5 ± 1.3° varus inclination to the femoral neck axis. The screw direction was virtually parallel to the femoral neck axis. The distance from the subcapital line to the three (proximal-anterior, proximal-posterior, and distal) screw thread ends was 12.0 ± 1.8 mm, 10.4 ± 2.4 mm, and 11.6 ± 4.0 mm, respectively.

Discussion

These results are encouraging in terms of adaptation of the device to the anatomical morphology of the Japanese population. Even in the case of Western populations, the TresLock may also be suitable because the reported neck angle in Western populations is between 129° and 135° [6, 7].

Figure 5: (a) At the time of injury, (b) post-operative, (c) 3 months after surgery, and (d) after bipolar hip arthroplasty.
effect, where the penetration of a screw and the back-out of other screws occurred simultaneously, with eventual significant displacement. Although the Pauwels III fracture had a steep fracture line (>50°) [8], the most proximal screw that was most adjacent to the fracture line kept stability in the femoral head. This complication might be caused by the insufficient depth of the distal two screws [9]. In this situation, a misbalanced load transmission could have occurred. We believe that a deeper insertion of the distal two screws could prevent this complication.

Conclusion

Although a longer follow-up study is needed, TresLock shows good anatomical compatibility for femurs among Japanese population. Sufficient depth of the screws might be crucial to avoid complications.

Clinical Message

TresLock is a new device and shows good anatomical compatibility for femurs.

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