

Reducing the Syndesmosis Under Direct Vision: Where Should I Look?

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Background/Purpose: Accurate reduction of the syndesmosis is considered critical in obtaining the best functional outcomes for patients with unstable ankle injuries. Many radiographic methods of reduction have been described in recent years; however, little attention has been paid to open techniques. Because the incisural anatomy varies and may be shallow and relatively unconstrained, the evaluation of the reduction at this level may be challenging and lead to anterior or posterior malalignment. We hypothesized that the relationship of the syndesmosis at the articular surfaces of the anterolateral plafond and the anteromedial fibula at the level of the joint may provide a better visual reference than the relationship of the fibula to the incisura above the joint. There were two aims of this anatomic study: (1) to compare the quality of the reduction of the syndesmosis using the relationship of the fibula to the tibia at the articular surface of the joint to that using the relationship at the incisura, and (2) to evaluate the width of the fibula to the corresponding tibial surface at the level of the articular surface to that at the level of the incisura.

Methods: Ten cadaveric ankles were used for this study. The soft tissues were removed to access the ankle and syndesmosis. Prior to sectioning, two 1.6-mm K-wires to be used later as reference points were driven from lateral to medial immediately adjacent to the anterior and posterior edges of the fibula approximately 1 cm above the joint line. These wires were pulled out medially and were not visible from the lateral side, nor were the holes they went through. The syndesmosis was then sectioned to a point 1 cm from the proximal tibiofibular joint as were the lateral ankle ligaments rendering the distal fibula mobile. Seven surgeons were asked to reduce the syndesmosis to the best of their ability and stabilize it in its anatomic position with a Kirschner wire (K-wire) (all K-wires had separate starting points between 1 and 2 cm above the joint). These reductions were done using either the articular surface at the anterolateral joint line or the entire incisura as a visual reference. For each method, green towels were used to mimic the available surgical exposure by covering areas that would not be visible during surgery. Three surgeons used the incisura technique first and four used the articular surface technique first. All surgeons used both methods for each specimen. Measurements were made using digital calipers to the tenth of a mm from either the anterior or posterior reference K-wire after pushing the wire back through the reference hole. The absolute values of the displacements were recorded. Comparisons of the reduction quality were performed using a paired t test with significance set at <0.05 . As the final stage of the study, a single investigator measured the anterior to posterior depth of the fibular and tibial articular surfaces at the level of the joint and the AP depth of the fibula and the incisura 1 cm above the joint using the digital calipers.

Results: The malalignment of the syndesmosis using the articular surface as a visual reference was 0.71 ± 0.7 mm and using the incisura was 1.2 ± 1.0 mm ($P = 0.0001$). The range of malalignment using the joint as a reference was 0.0 mm-2.5 mm and using the incisura was 0.1 mm-4.8 mm. All seven reviewers yielded better reductions using the articular surface

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than using the incisura as a reference. The second part of the study evaluated the width of the fibula versus the incisura at the level of the articular surface and at 1 cm above the joint. The difference in the fibular width and the tibial incisura width was less at the level of the articular surface than at 1 cm above the joint (2 mm vs 6 mm; $P = 0.0003$).

Conclusion: We sought to evaluate the accuracy of two visual reference methods for open reduction of the syndesmosis in this cadaver study. Our findings indicate that using the articular surface of the anterolateral tibia and the anteromedial fibula at the level of the joint is a more accurate method than using the relationship of the fibula to the incisura above the joint level. Measurements of the difference of the fibula and incisural width at the joint and 1 cm above the joint may provide an explanation for this as there is much closer relationship at the level of the articular surface, which would potentially lead to a better reduction when using this relationship as the visual reference.