

Restoring Wrist Rotation in Injured Pianists and Violinists

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Wrist fractures are common injuries in musicians, and a number of these fractures heal in a mal-united position, interfering with wrist rotation. This can prevent musicians who play keyboard instruments and the smaller string instruments from assuming the required wrist positions. Resection of the distal ulna (Darrach procedure), while somewhat discredited for the general population, has proved to be the ideal operation for this problem in musicians and has been used successfully on five professional musicians. This procedure, the rationale for its use in musicians, and the important technical details are discussed. *Med Probl Perform Art* 2009; 24:88–90.

The wrist is a complex joint consisting of two components: the *radiocarpal joint*, between the radius and the proximal row of carpal bones in the hand, allows flexion and extension of the wrist and radial and ulnar deviation; and the *distal radioulnar joint* (DRUJ), between the radius and the distal ulna, allows rotation of the wrist. Normal rotation allows nearly 180° of motion, from palm downward (pronation) on a flat surface to palm upward with the back of the hand on the flat surface (supination).

Many musical instruments are played in the neutral or mid-pronated position and this applies to most woodwind and reed instruments and to the larger string instruments (though both the French horn and trombone require supination in the left wrist). However, all keyboard instruments require full pronation in both wrists, and the smaller string instruments, violin and viola, require full and even hyper-supination in the left wrist. One therefore needs mobility in the DRUJ to play these instruments.¹

The most common cause of injury in musicians is coincidental trauma—falls, trips, kitchen and automobile accidents, etc.² Wrist fractures are among the most common injuries and, naturally, do occur in musicians. From experience, the most commonly injured groups of musicians are those playing the most popular instruments—piano and violin³—and thus a significant number of pianists and violinists will suffer wrist fractures, some of which will heal in malunion compromising wrist rotation.

The spectrum of wrist fractures ranges from undisplaced radial styloid fractures, which heal quickly without any residual long-term loss of mobility, to highly comminuted fractures of the distal radius, the radiocarpal, radioulnar joint

surfaces, and the ulna itself. The Colles' type of fracture, with displacement of the radius distal to the fracture dorsally, is common. The standard principle in treatment of all wrist fractures is accurate reduction restoring alignment and length to the radius, accurate reduction of the joint surfaces, including the DRUJ, and, if such reduction cannot be obtained or maintained by closed means, to use open reduction and one of the many means of bony fixation.

In a musician one should resort to open reduction earlier, as no compromise can be accepted, particularly to the DRUJ. However, some fractures are just too comminuted to allow accurate reduction, even using open techniques, and heal with radial shortening and disruption of the DRUJ (Figure 1A). Colles' fractures, even with accurate reduction, tend to collapse during healing, related to comminution of the dorsal cortex causing radial shortening and disruption of the DRUJ.^{4,5} This pattern is seen surprisingly frequently in female pianists and piano teachers over the age of 60. Unable to pronate, they cannot play their instruments. The violinist unable to hyper-supinate with the left wrist is similarly unable to play (Figure 1).

In the younger patient with a malunion restricting wrist rotation the correct approach, if technically possible, is a corrective osteotomy realigning the radius or shortening and realigning the ulna to restore better mechanical relationships in the DRUJ.⁶ However, in some younger patients with severe shortening and malalignment, this may not be technically possible (Figure 1A). In patients over 65 yrs old, this approach may also be contraindicated because of the complexity of the surgery, the long rehabilitation process, and the inevitable unpredictabilities of delayed or nonunion, prolonging the need for immobilisation and resulting in persistent stiffness. In these circumstances a number of surgical options are available, including resection of the distal ulna—the Darrach procedure.

Over the last 15 to 20 yrs, considerable research has centred on the role of the DRUJ on wrist and forearm mechanics. This joint proves important in both wrist rotation and in transferring axial loading from the hand to the forearm. Axial loading occurs when there is forcible contraction of the forearm flexor muscles against strong resistance, as in heavy lifting or powerful grasping and twisting. Eliminating this joint does cause weakness and potential forearm instability in individuals involved in such heavy activities. Hence, in such (especially younger) patients, the Darrach procedure has been surpassed by alternatives including prosthetic replacement of the DRUJ.^{6,7}

These procedures are effective in preserving strength and a stable relationship between the forearm bones in situations where this is as important as unimpeded movement. However, musicians requiring full pronation or full supination and in

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FIGURE 1. A, The malunited radial fracture of a 46-year-old professional orchestral violinist with radial shortening and gross disruption of the DRUJ.



FIGURE 1. B, The maximum supination possible 5 mos after injury, barely allowing the musician to support the neck of the violin.

some cases hyper-supination, are not subjecting their arms to axial loading. They require predictable, rapid restoration of the required movement with a short recovery time, allowing very early return to playing as part of the rehabilitation program.⁸ The Darrach procedure can provide this as long as some fundamental operative and postoperative steps are taken.

The operation of resection of the distal ulna was first reported in 1912 but was more completely analysed and described in 1952.^{9,10} The important technical point stressed by Dingman¹⁰ is a minimal resection of the distal ulna. Numerous failures of the procedure, resulting in painful instability of the distal ulna stump or migration of the forearm bones relative to each other, have been described in the literature, discrediting the procedure, but these are almost always associated with technical mistakes including excessive resec-



FIGURE 1. C, Postoperative radiographs showing a 1.5-cm excision of the distal ulna (Darrach procedure).

tion of the distal ulna.¹¹ Indeed, when this operation is performed on musicians, only 1 to 1.5 cm of ulna should be resected (only enough to clear the joint surface of the radial facet and allow full passive motion in the musically required direction under anaesthesia). Pronator quadratus muscle attachments to the ulna must be left intact, and a strong capsular repair reinforced by flaps of extensor carpi ulnaris tendon sheath, facilitated by an initial dorsal approach to the joint, should be used. Nonunited ulnar styloid fragments can be left *in situ*.

We have performed this operation, adhering to these strict technical guidelines, on many nonmusician patients over the years. We have achieved excellent restoration of wrist rotation and are unaware of any “floating ulnas.” We have also had the opportunity to use the Darrach procedure in three younger professional violinists with severe wrist fractures and noncorrectable malunions, a number of older amateur female pianists, and two active elderly female piano teachers following a Colles’ fracture with collapse. In the musician population, we monitored professional musicians by using as the measurable parameters in this group return to full playing (and earnings), time off the instrument, and time to full professional playing.³

CASE DISCUSSION

This case highlights a number of important points in the elective surgical care of musicians:

1. The Darrach operation must be properly indicated after all other methods of treatment—extensive physiotherapy,



FIGURE 1. D, Supination achieved 6 wks after surgery, with fingering possible to all but the two highest positions which are essential for orchestral playing.

adjustments of playing technique, or adjustments of the instrument where applicable—have been exhausted and corrective osteotomy has been discounted.

2. The surgery must be performed with technical precision.
3. Anticipated loss of motion should be adjusted to lie outside the required playing positions and musical range.
4. Very early return to the instrument has to be facilitated and instrument-focused rehabilitation started at a very early postoperative point.⁸
5. Additional help may be required from suitable music teachers to complete recovery to previous musical levels. This advice should concern technique or the instrument itself, where modification of one or both may overcome any final minor or subtle residual deficits.¹²

Monitoring the progress of the three violinists, the time from surgery to the first limited contact with the instrument (air-playing or simple scales for a few minutes per day) averaged 2 wks. The time to full orchestral playing in the case of the violinists averaged 5.8 mos. The time off the piano for the two teachers was 1.5 wks and to full piano teaching was 13 wks. All three professional violinists returned to their full professional careers. The patient shown in the figures dropped back one chair in the orchestra but continues to play fulltime 12 yrs after his accident and reconstruction. The two piano teachers returned to fulltime teaching. There were three talented amateur pianists, all of whom have resumed playing at their desired preinjury levels. However, due to the fact that they are amateurs and thus the parameter of return to professional playing is absent, they are not included in this study.



FIGURE 1. E, Final position achieved with fingering to the 8th and 9th positions achieved by slight alteration in technique supervised by a rehabilitation violin instructor.

DISCUSSION

Darrach procedure (excision of the distal ulna) for restoration of wrist rotation after fracture has been discredited to some extent due to complications, most of which are due to poor patient selection or faulty surgical technique. However, in musicians with loss of the required mobility in the DRUJ following wrist fractures, this operation is ideal. It is simple and predictable if performed properly, and recovery is rapid, allowing very early rehabilitation on the instrument. It is durable in this very specialised group, who require painless wrist mobility in their musical range but do not subject their arms to strenuous axial loading. It has been used successfully on five professional musicians, with each of them returning to their full professional career.

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