Technical Note

The Radial Portal for Scaphotrapeziotrapezoid Arthroscopy

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Abstract: The scaphotrapeziotrapezoidal (STT) joint is a complex joint in which the arthroscope and instruments can be used through the radial midcarpal and STT-ulnar portals. This report describes a new arthroscopic portal at the STT joint to complete and improve the evaluation and treatment of this joint by arthroscopy: The STT-radial (STT-R) portal is situated immediately radial to the abductor pollicis longus at the STT level. Five cadaveric wrist specimens were dissected immediately after the portal was established, and photographed to determine the proximity of neurovascular structures. Magnetic resonance imaging evaluation of 15 hands was performed to measure the proximity of the radial artery. A cadaveric distal scaphoid excision was also created arthroscopically to show the real usefulness of this portal. Results of the anatomic study showed that no lesions of nerves or vessels were seen at this portal. Magnetic resonance imaging showed that the radial artery was located at a safe distance from the portal. The distal scaphoid excision was performed 15 minutes after the STT portals were established. Our results suggest that this new portal is safe and effective. **Key Words:** Arthroscopy—Scaphotrapeziotrapezoid joint.

In this article, we describe a new portal at the scaphotrapeziotrapezoidal (STT) level that can be used in the evaluation and treatment of this joint by arthroscopy: The STT-radial (STT-R) portal. A cadaveric and magnetic resonance imaging (MRI) study was performed to determine the safety and utility of this new portal. A cadaveric distal scaphoid excision was also achieved arthroscopically.

The traditional treatment method for surgery of the STT joint requires a global exposure with direct visualization through an arthrotomy. Extensive surgical exposure increases the potential for complications. Recent advances for visualization and instrumentation in thumb arthroscopy allow access to all areas of first carpometacarpal joint[1-3] and metacarpophalangeal joint.[4,5] As far as we know, only one STT portal has been described in the literature. In this report, the portal was performed just ulnar (STT-U) to the extensor pollicis longus, in line with the radial margin of the second metacarpal.[6] Evaluation and treatment of the STT joint has been described using the radial midcarpal portal (RMC) and the STT-U portal.[6] The STT joint can be scoped through the RMC portal, and some instrumentation is possible through the STT-U portal. Lee et al.[7] presented limitations in the visualization of the STT articular surfaces using conventional portals.

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TECHNIQUE

Arthroscopic Distal Scaphoid Excision

To illustrate the usefulness of this portal and possible clinical applications, we performed an excision

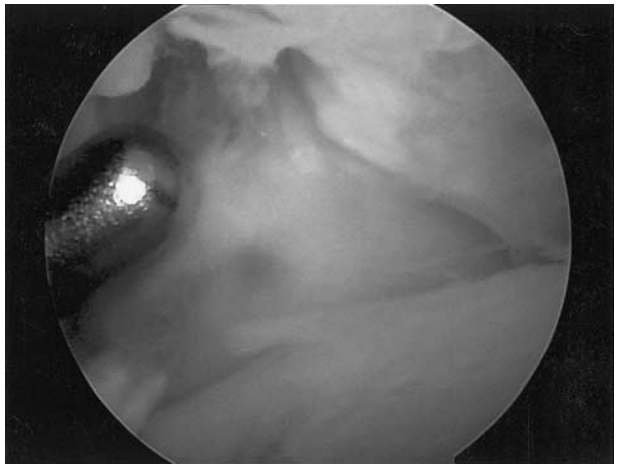

FIGURE 1. A view of the left hand shows the arthroscopy probe in the STT-R portal and in the STT-U portal. The trapeziotrapezoid joint, bones above, and the distal pole of the scaphoid below can be seen.

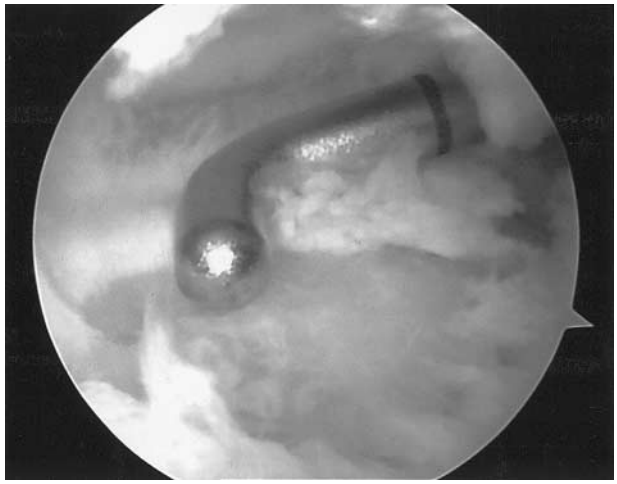

FIGURE 2. A view of the left hand shows the arthroscope in the STT-U portal and STT-R portal. The distal pole of the scaphoid is also shown.

of the distal pole of the scaphoid under arthroscopic control. For this purpose, a cadaveric distal scaphoid excision was achieved arthroscopically. An incision was made in the radial portal of the STT joint (STT-R), radial to the abductor pollicis longus tendon, and a 1.9-mm 30° oblique arthroscope was inserted into the joint. The orientation landmarks for viewing from this portal are in front of the capitate bone, above the trapeziotrapezoid joint and bones, and below the distal pole of the scaphoid (Fig 1). Debridement of all hyaline cartilage and underlying subchondral bone was accomplished using a 2-mm full-radius and a 2.9-mm burr through the ulnar portal (STT-U) (ulnar to the extensor pollicis longus).

Viewing and working portals were interchanged to complete the distal scaphoid excision (Figs 2 and 3). The procedure was performed without technical problems in 15 minutes after the establishment of the STT portals. Radiographs confirmed excision (Fig 4). The excision of the distal pole of the scaphoid under arthroscopic control showed that visualization and surgery using STT portals is excellent.

Anatomic Study

Five fresh-frozen cadaveric upper limb specimens were fixed in formalin and vertically suspended by a single Chinese finger trap on the thumb. Four kilograms of longitudinal traction was applied to the thumb. The tendons of the abductor pollicis longus and extensor pollicis brevis were palpated and marked. STT-R and STT-U portals were created for each of the specimens. We also created portals in the trapeziometacarpal (TM-R and TM-U) and metacarpophalangeal joints (MP-R and MP-U) to complete the study of arthroscopy of the thumb. TM portals were established first with a 20-gauge needle to help identify the articular space of the STT.

We then began the STT technique. A 20-gauge needle was used to find the articular space at the STT-R portal just radial to the abductor pollicis longus, and the joint was distended with 5 mL of normal saline. After the skin was lanced longitudinally by pulling it against the tip of a No. 11 scalpel, the deep layers and subcutaneous tissue were penetrated and spread with a mosquito clamp followed by a 2.2-mm

FIGURE 3. View after distal scaphoid excision. The burr is in the STT-R portal.

FIGURE 4. Radiographs confirm excision of the distal pole of the scaphoid.

cannula and blunt obturator. A twisting motion was used to perforate the capsule, and a 1.9-mm 30° oblique arthroscope was inserted into the joint. The STT-U portal was then created under direct visualization, just ulnar to the extensor pollicis longus. Short, 3-mm barrel cannulas were left in place at the portals, and the specimens were immediately dissected, examined, and photographed to measure the proximity of the neurovascular structures.

The angle between the 2 portals (ulnar and radial) was wider in the STT portals than in the TM and MP portals (130° *v* 100°). Analysis of the data from cadaveric study found no incidence of contact between the tract of the new portal and the radial artery at the STT level. Maintaining a position palmar and radial to the abductor pollicis longus at the STT level avoids the radial artery by 6 to 10 mm (mean, 8.8 mm), depending on the specimen size (Figs 5 and 6). No visible damage of nerve or vessels was noted at either portal (STT-R and STT-U). Although no lesion was found on the superficial branches of the radial nerve, the arborizations of the dorsal cutaneous branches of this nerve lie in the vicinity of all thumb portals, and the location of these cutaneous branches are variable surrounding the arthroscopic field (Fig 7). The proximity of the nerve branches must be considered from these findings, and the dissection of the deep layers, after the skin is incised, must be carefully performed transversely to allow the nerve branches to roll aside if the cannula comes in contact with the nerve. Dorsal veins generally have a longitudinal orientation and are highly variable in number. They are also fairly mobile in subcutaneous tissue and can be easily displaced from side to side. Dorsal veins are vulnerable to scalpel laceration, but the introduction of blunt or tapered instruments displace them without injury.

MRI Study

In the anatomic study, we determined that the higher risk for this portal was at the entrance into the joint, because then the tract goes to the palm of the hand and the radial artery continues dorsally. MRI

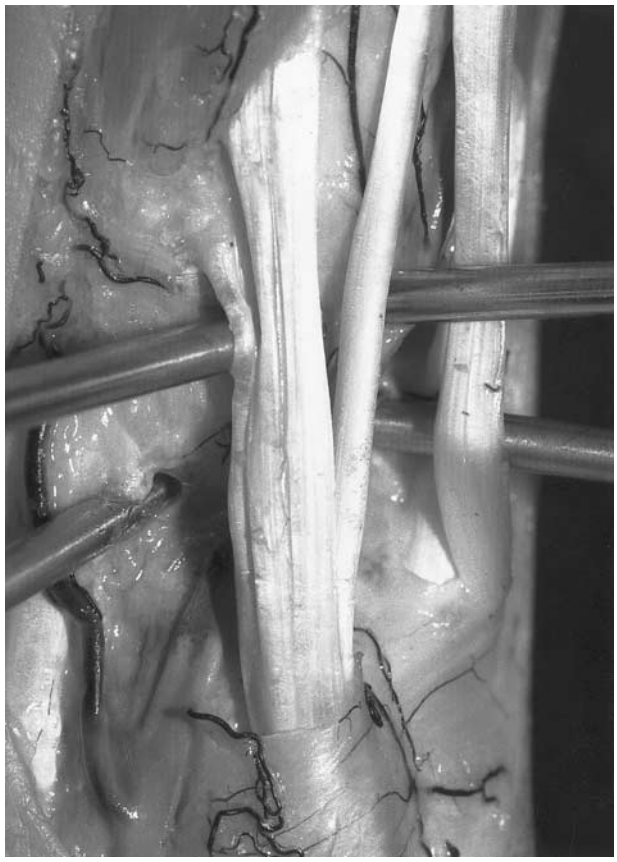

FIGURE 5. Anatomic study shows the STT and TM portals.

FIGURE 6. Anatomic study shows a close view of the STT-R portal, palmar, and radial to the abductor pollicis longus. The STT-R portal avoids the radial artery by 6 to 10 mm.

was performed to determine the possibility of radial artery anomalies at this point. The study population consisted of 15 asymptomatic volunteers (8 men and 7 women; 19 to 42 years of age; mean age, 26 years). MRI was performed with a Signa 1.5-T scanner (General Electric Medical Systems, Milwaukee, WI), with paired 3-inch circular coils. Patients underwent scanning in the prone position with the wrist overhead in the isocenter of the magnet, in neutral rotation and extension so that the central axis of the first metacarpal lined up with the long axis of the radius. The fingers were flexed, reproducing the position of the arthroscopic examination.

The MRI protocol included T1-weighted spin-echo images in the axial, coronal oblique (perpendicular to the trapeziotrapezoidal joint), and sagittal oblique plane (parallel to the trapeziotrapezoidal joint) with a repetition time (TR) of 500 ms, echo time (TE) of 20 ms; axial fat-suppressed T2-weighted fast spin-echo images (TR/TE, 3000/50 ms); and axial and coronal oblique spoiled gradient echo images (SPGR) with a TR of 33 ms and a TE of 9 ms. Three-dimensional phase contrast (PC) MR angiography using thin-section gradient-echo pulse sequences were also obtained to analyze the arterial anatomy and potential arterial variations. The following parameters were used: TR, 18 ms; TE, 10 ms; flip angle, 15°, and 3-mm thickness with an interval −1.5-mm interslice gap. An encoded velocity of 15 cm/s was chosen to optimize visualization of the small feeding arteries. Based on the anatomic viewpoint of the cadaveric study and volumetric data of the 3-dimensional PC MR angiography images, we delineated the theoretical trajectory of the STT-R portal. Posteriorly, we moved the axes of this trajectory to conventional 2-dimensional sequences obtained in the coronal plane (perpendicular to the STT joint). We then measured the distance between the point of this trajectory just

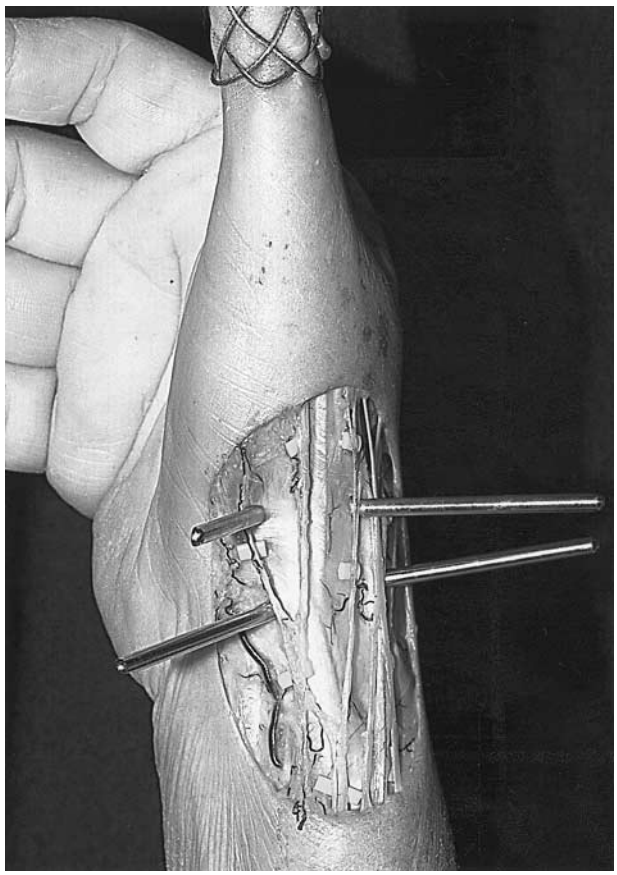

FIGURE 7. Anatomic study shows branches of the superficial radial nerve surrounding the arthroscopic field.

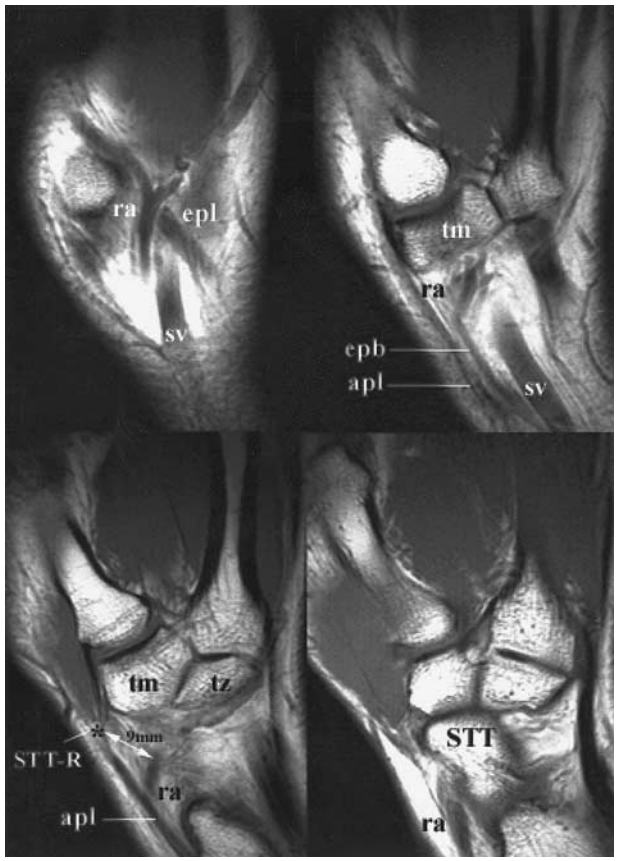

FIGURE 8. MRI showing the distance between the STT-R portal and the anatomic course of the radial artery. In this specimen, it is 9 mm. (ra, radial artery; epl, extensor pollicis longus; sv, superficial vein; tm, trapezium; tz, trapezoid; epb, extensor pollicis brevis; apl, abductor pollicis longus; STT-R, scaphotrapeziotrapezoid radial portal; STT, scaphotrapeziotrapezoid joint.)

radial to the abductor pollicis longus at the STT level, the point of maximal anatomic risk with the STT-R portal, and the outer margin of the radial artery.

We performed a complete MRI study with multiple sequences and planes. We believe that this coronal oblique sequence T1-weighted image shows the more comprehensive anatomic view and the view that more closely matched the arthroscopic view. Analysis of the data from MRI found the same results as the cadaveric study: The MRI study did not reveal any incidence of contact between the site of entry of the new portal and the radial artery at the STT level. The variability of the distance between the STT-R portal and the anatomic course of the radial artery ranged between 6 and 10 mm (mean, 8 mm) (Fig 8). Therefore, we found this new portal to be safe and effective.

DISCUSSION

The STT joint is a complex joint. Standard approaches may prove difficult because of the relative depth of the joint, local anatomic factors limiting extensile exposure, and concern over disruption of the substantial ligament support. Arthroscopy of the carpometacarpal joint[1-3] and the metacarpophalangeal joint[4,5] is a recently established procedure for treatment of these joints. The technique for STT arthroscopy described here makes the arthroscopic treatment of different diseases in this joint feasible, using a minimally invasive technique with little surgical morbidity. This technique includes the same potential advantages of other arthroscopic procedures.

The potential complications of STT surgery are the same as for any other surgical technique in the upper extremity. However, this procedure carries specific risks. First, the superficial radial nerve typically has branches, named SR2 and SR3 by Steinberg et al.,[8] that virtually surround this arthroscopic field. The approach to the joint capsule may damage these

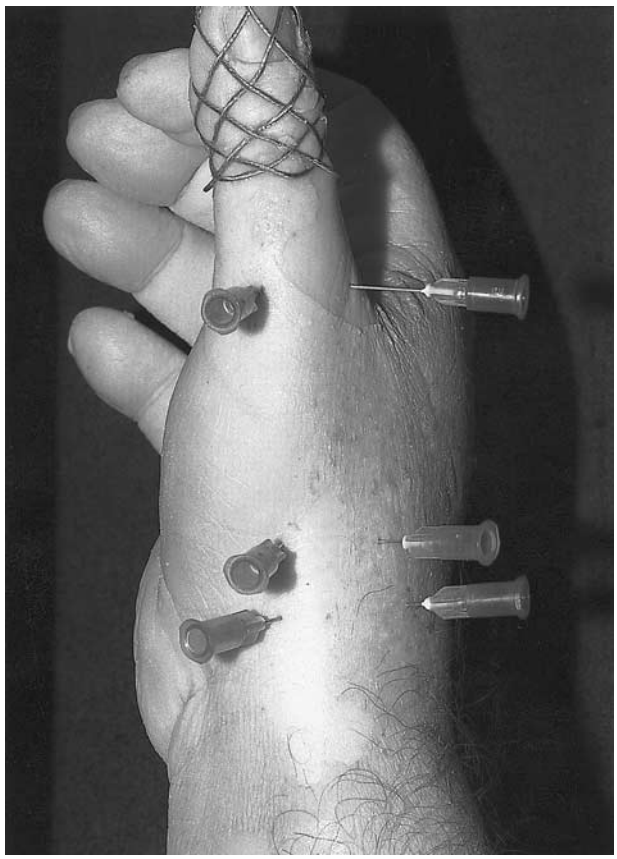

FIGURE 9. Needles at the 3 floor levels for thumb arthroscopy.

branches, with the potential results of altered sensory function and the development of a painful neuroma. Second, the radial artery enters the anatomic snuff box by emerging dorsally from beneath the first extensor compartment. It then courses distally in a groove to enter the thumb web space over the dorsal aspect of the first metacarpal base. This artery is located immediately dorsal and proximal to the STT-R portal and may be inadvertently damaged. Knowledge of the anatomy of the region, with extensor pollicis longus and abductor pollicis longus as local landmarks coupled with careful blunt dissection as the joint capsule is approached, will minimize the risk of injury to these structures. Maintaining a position palmar and radial to the abductor pollicis longus at the STT level avoids the radial artery at a safe distance. Although MRI and anatomic study have shown that no radial artery anomalies exist in this area and review of the literature[9] does not show a radial artery located at this point, a careful dissection must be performed to reduce the risk of potential injuries.

This new portal at the STT level completes and improves the ability to evaluate and treat this joint arthroscopically. Additionally, the position of the thumb in traction allows the surgeon to perform arthroscopy and treatment in the other joints of the thumb.

We believe that the main indication for STT arthroscopy is the excision of the distal pole of the scaphoid under arthroscopic control. Recently, Barron and Eaton[10] and García Elias et al.[11] described the utility of this excision for treating stage IV disease of the basal joint and STT osteoarthritis, respectively. This distal pole excision has been also described for treatment of scaphoid nonunions by open surgery[12,13] and has shown excellent short-term results. The traditional surgical method for the STT joint requires a global exposure with direct visualization through an arthrotomy. Extensive surgical exposure introduces additional potential for complications. Arthroscopic treatment of the STT joint shows the same potential advantages that other arthroscopic procedures show. Recently, arthroscopic excision surgery of the distal pole of the scaphoid via radiocarpal arthroscopy has been described for the treatment of avascular necrosis of the proximal pole after scaphoid nonunion, with good results.[14]

CONCLUSIONS

The technique of creating an STT-R portal just radial to the abductor pollicis longus is safe, effective, and reproducible. Therefore, there are 6 possible portals for thumb arthroscopy: MP-R and MP-U, TM-R and TM-U, and STT-R and STT-U (Figs 9 and 10).

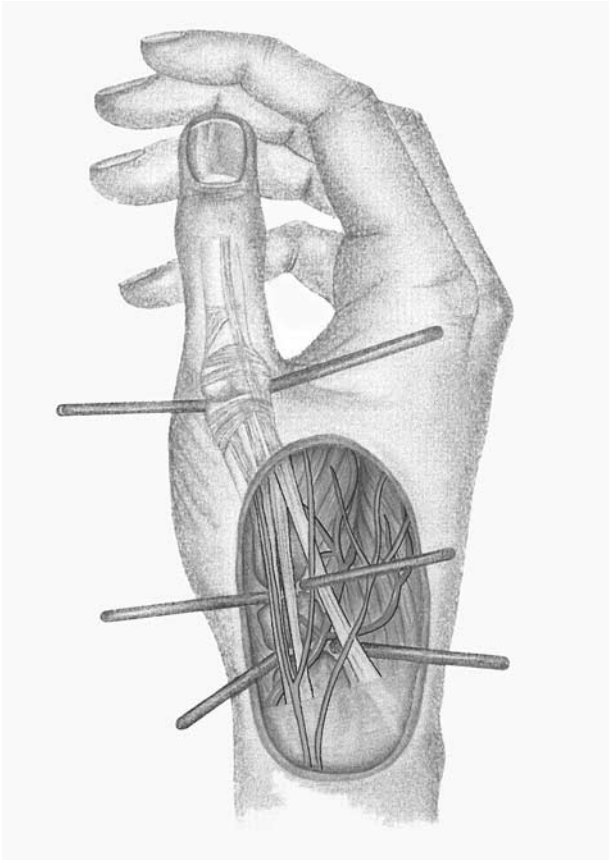

Figure 10. Drawing of the 6 portals for thumb arthroscopy: The MP-U and MP-R, TM-R and TM-U, and STT-R and STT-U.

Indications for STT arthroscopy are diagnostic arthroscopic examination for pathology of traumatic, inflammatory, or degenerative origin; extraction of loose bodies and joint debris; arthroscopic shaving of the articular defects to reduce friction between opposing irregular surfaces during motion, or to obviate the enzymatic response after particle sloughing; abrasion or microfracture in degenerative joint diseases; and synovectomy. In basal joint arthritis, the indications include trapeziectomy, double interposition arthroplasty and distal scaphoid excision. In addition, many times arthroscopy of the trapeziometacarpal joint can detect articular cartilage damage long before the radiologic changes become evident. Therefore, we believe arthroscopy should be performed for both the TM and STT joints before any surgical decision is made or for adding treatment such as debridement of synovial hypertrophy and cartilaginous fibrillations in

early degenerative disease. Introduction of a new group in the staging system for basal joint disease based on arthroscopic findings for both the TM and STT joints is also encouraged.

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