

## TECHNIQUE

## Limited Open Incision Carpal Tunnel Release

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### ■ HISTORICAL PERSPECTIVE

Open carpal tunnel release has relieved symptoms of median nerve compression at the wrist for more than 40 years. The technique was popularized by Phalen in the 1950s for surgical treatment of carpal tunnel syndrome. In 1989, Chow (6) described a two-portal endoscopic technique for carpal tunnel release that modified his and others' previously reported bursal technique (7,8,14,18,19). The use of endoscopy by Chow and others (7,8) demonstrated that there was a reduction in tissue trauma and a quicker postoperative recovery for patients.

Agee et al. have reported on a study that compared open and endoscopic carpal tunnel releases (2,3). This study reported that pinch and grip strength was greater with less scarring and pillar tenderness when the endoscopic technique was used in patients treated for carpal tunnel release. These authors also found that patients returned to their daily activities in 5 days and to work in 16.5 days, compared with the conventional open carpal tunnel release patients who began daily activities after 13 days and work after 45.5 days.

Recent studies by Brown and others (4,5,17) confirmed the conclusions made by researchers who described the success of endoscopic carpal tunnel release. MR imaging has shown an increase in the volume of the carpal canal (1,11), following endoscopic carpal tunnel release (2,5).

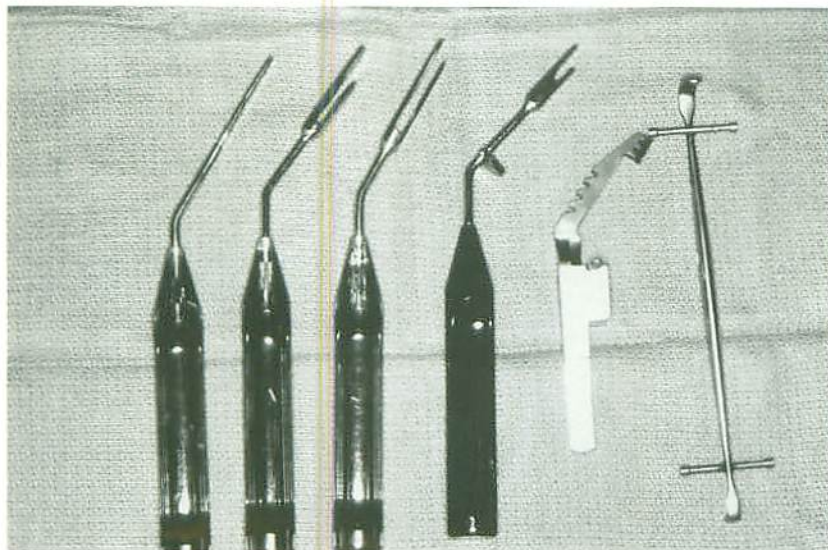
Controversy has existed concerning the endoscopic technique of carpal tunnel release (9,10,12). Critics of this modality point to the elaborate and costly equipment required for the procedure (15,16). Many clinicians believe there is a steep learning curve (20) with many complications reported, including transection of the median nerve or its branches, the ulnar nerve, and the superficial palmar arch, to name a few.

In 1992, Dr. James W. Strickland, at the Indiana Hand Center, developed the carpal tunnel tome. This cutting instrument divides the transverse carpal ligament through a small palmar incision (13) (Fig. 1). The tome's efficacy and safety was tested on cadavers. This device has been shown to rival and, by some clinicians, replace the endoscopic or classic carpal tunnel release. This technique combines the simplicity and safety of the open carpal tunnel release with the advantage of reduced tissue trauma and postoperative morbidity of endoscopic release (18,19).

### ■ INDICATIONS/CONTRAINDICATIONS

Carpal tunnel syndrome can be diagnosed by obtaining a careful patient history. Nocturnal paresthesias, a heavy feeling, or hands "going to sleep" while driving a car or while engaged in hair brushing are all common complaints. A small percentage of patients may complain of pain at the wrist crease. This pain may radiate up the arm and be present in the shoulder and neck area 40% of the time. A patient may complain of weakness that has hindered his or her grasp of objects, and in fact some patients indicate they drop objects frequently. Numbness when performing gripping activities such as lifting is another

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**FIG. 1.** Instruments necessary to perform a limited open carpal tunnel release.

common complaint. When the pressure in the carpal canal reaches its apex, numbness may ensue and the normal function of the median nerve is diminished.

Two-point discrimination or sensibility may be found on examination to be reduced throughout the area supplied by the median nerve. Numbness is sometimes present in the ulnar digits of patients. The Semmes Weinstein monofilament test is one of the most accurate tests to help diagnose carpal tunnel syndrome. A more common test used by physicians is the Phalen's flexion test, which can reproduce symptoms in patients and this test has been found to be most sensitive. The Tinel's nerve percussion test has been shown to be the most specific test to help diagnose carpal tunnel syndrome. These two tests help support a patient's history. Radiographs of the carpal tunnel and nerve conduction velocity studies may be used by some physicians to help confirm the diagnosis of carpal tunnel syndrome.

In patients younger than 50 years of age who have the early stages of carpal tunnel syndrome, a custom wrist splint may be used to relieve symptoms in the hands. If this modality is refractory, good results with an injection of a synthetic steroid can at times be helpful. The presence of symptoms of carpal tunnel syndrome after failed conservative treatment may require a carpal tunnel release.

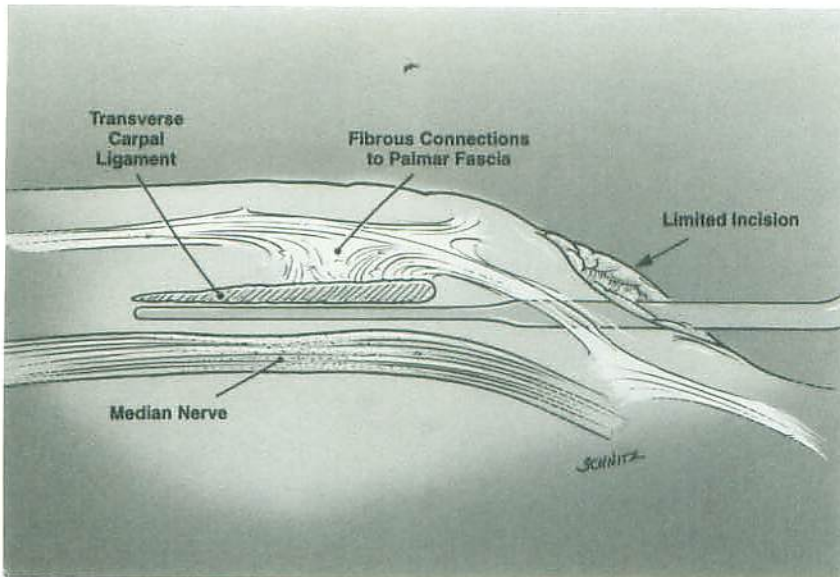
There are several contraindications with the limited open incision technique. If the patient is known to have a mass in the carpal canal this limited incision will not allow full inspection of the mass, which may extend through the whole confines of the carpal canal. A tenosynovectomy of the flexor tendon cannot be performed through this small incision. When these exceptions do not exist, routine carpal tunnel surgery can be performed successfully through this limited open palmar technique.

## ■ TECHNIQUE

The technique begins with a localized injection of anesthesia, at the wrist and into the carpal canal. A 2- to 2.5-cm incision is made parallel to the radial side of the ring finger and one-third distal to and two-thirds proximal to a proximal line extending slightly off of the distal border of the thenar muscles (interthenar incision).

A Miltex retractor is introduced and positioned in the wrist. The retractor should be lowered by rocking it side-to-side and moving tissue walls apart with the help of a small freer. The superficial palmar fascia is incised in line with its fibers and the self-retaining retractor is placed deeper into the depths of the wound. A Ragnell retractor is placed in the distal aspect of the incision. A Littler or similar scissors is used to spread the soft tissue to identify the fat, which pouches up at the distal aspect of the transverse carpal ligament. This fat also helps identify the superficial palmar arch. A Ragnell right-angle blade retractor is used to expose the distal/proximal tissues until at least one-third of the distal transverse carpal ligament is easily seen. When the ligament is cleared away of all overlying tissues, a scalpel (64 Beaver blade) is used to incise it for a distance of 1 cm. The distal end of the ligament is cut until the fat overlying the superficial palmar arch is exposed. The median nerve and other carpal tunnel contents can then be identified and protected throughout the remainder of the operation. This small opening in the carpal canal allows for passage of all other instruments.

A smooth blunt pilot instrument is then placed between the underside of the transverse carpal ligament and the contents of the carpal canal, proximally (Fig. 2). The instrument is withdrawn and a Palmer Stripper is then placed under the ligament and into the wound under direct vision. The sharp 15-mm stripper is useful in that it



**FIG. 2.** Introduction of the blunt pilot beneath the transverse carpal ligament.

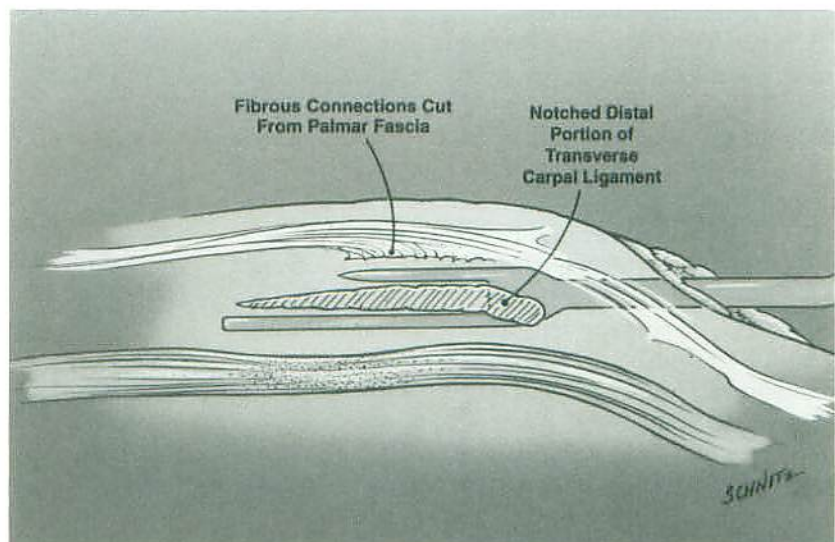
is designed to prepare a channel through the thick connecting tissues directly palmar to the ligament. The stripper is then inserted into the groove that has been formed by the distal division of the ligament. The stripper continues to be pushed proximally until resistance is felt as the body of the instrument impacts on the apex of the incised ligament. The ligament is prevented from being penetrated by the instrument because of the design and the ligament-straddling effect from the two skids (Fig. 3).

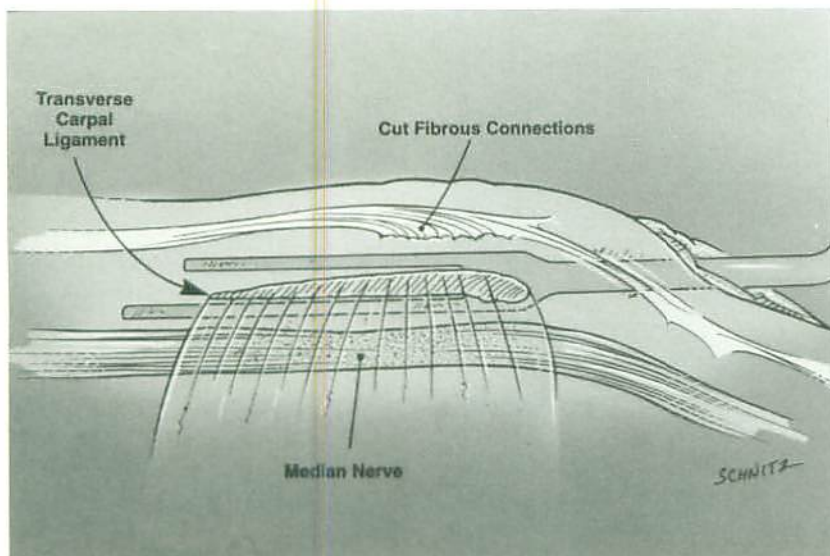
The Palmer Stripper is withdrawn from the groove and a double pilot instrument is now introduced. The instrument has long, dull lower and upper skids. The lower skid allows for full visualization of the passageway beneath the ligament. The skids are slightly wider than

those of the cutting instrument and have no sharp edges that can cut or damage the median nerve or any other significant structures. The pilot enters the opening created by the small incision in the distal transverse carpal ligament and rests on top of the ligament as it passes proximally to establish an area in which the cutting tome can enter. The proximal movement soon stops as the central part of the blunt skid makes contact with the proximal ligament's edge. This instrument will help ensure a safe passage from above and below the transverse carpal ligament (Fig. 4).

The double pilot is removed and the tome guide is inserted between the undersurface of the transverse carpal ligament and the carpal tunnel contents. The tome guide

**FIG. 3.** Channel-preparing instrument creates a pathway through dense palmar tissue above the ligament.





**FIG. 4.** Double pilot instrument straddles the transverse carpal ligament and ensures a clear path above and below.

is placed proximal to allow complete division of the transverse carpal ligament.

The cutting tome is selected in preparation for dividing the transverse carpal ligament. The design of the tome helps avoid contact with the median nerve, even if the instrument accidentally penetrated the ligament. There is a safety triangular stopper on the stem to stop passage of the instrument after it has already divided the remaining 2.5–3 cm of the transverse carpal ligament/antibrachial fossa (Fig. 5). Complete division of the ligament is guaranteed and injury to tissues and structures beyond the carpal tunnel is avoided with the use of the tome guide that rests in the channel created by the lower skid of the double pilot.

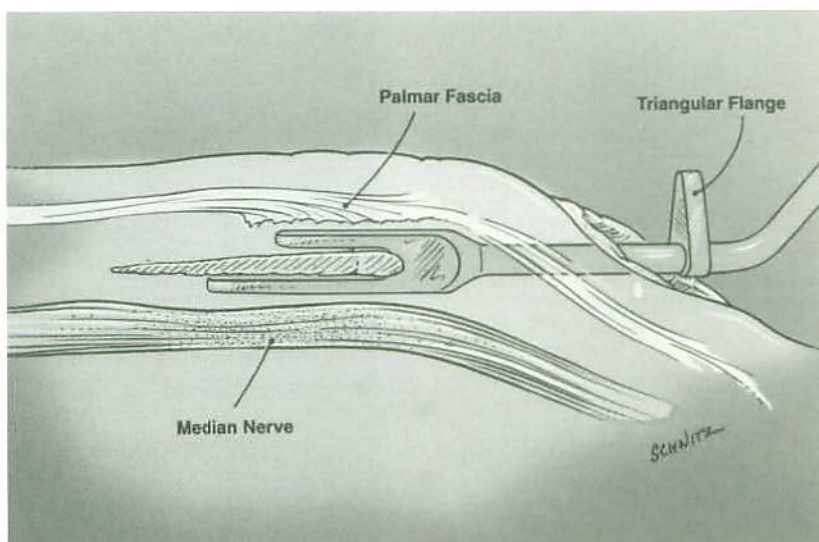
The cutting tome is then inserted into the prepared ligament (Fig. 6) and passed proximally with the wrist

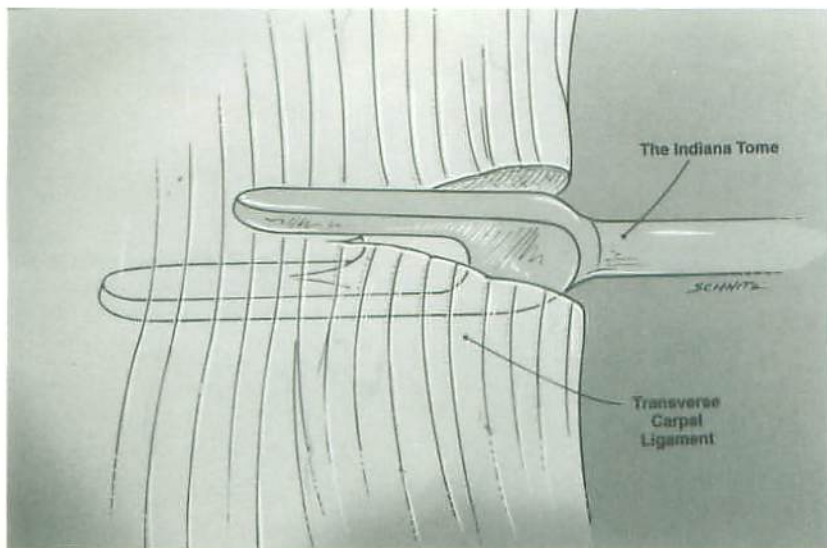
fully hyperextended (Fig. 7). Under no circumstances should the cutting tome be reintroduced into the wound and used again after the primary ligament transection has been completed; additional security can be attained by reinserting the blunt single pilot before the use of tome.

The cutting tome is removed and with the retractor still in place it is possible to see the separated leaves of the ulnar and radial transverse carpal ligament. The median nerve and motor branch and carpal contents can now be inspected. Clinical photographs of the procedure are shown in Figs. 8A–J.

The skin is closed with one to two sutures of 5-0 nylon and then a soft dressing followed by an elastic or Ace bandage is applied to the palm and wrist area. Digital range-of-motion and tendon gliding exercises are taught

**FIG. 5.** Introduction of the cutting carpal tunnel tome with a sharp center knife and a blunt protective upper and lower skid.





**FIG. 6.** The carpal tunnel release using the carpal tunnel tome.

to the patient in the operating room. The patient returns for a follow-up and change of dressing at 10–14 days when all sutures are removed.

### ■ COMPLICATIONS

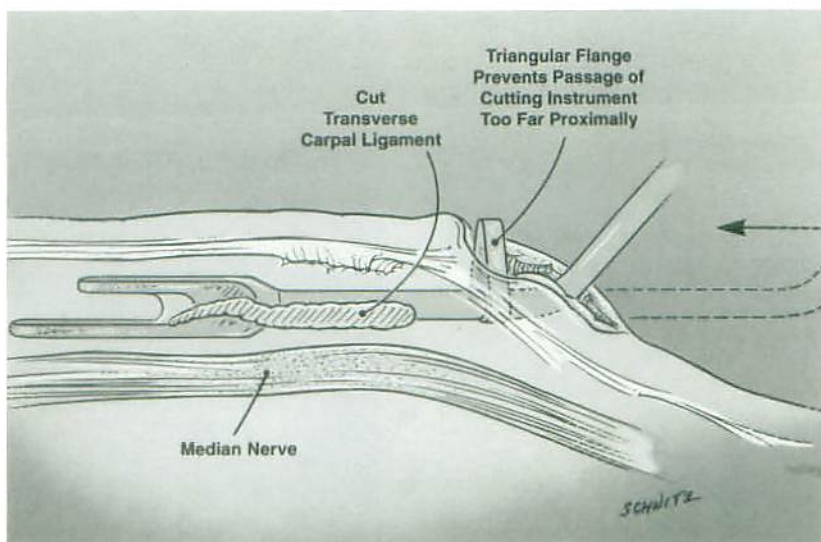
Complications a surgeon may encounter with this device are rare. The diagnosis of carpal tunnel must be accurate and conservative treatment when appropriate should have been attempted. This procedure should *never* be used for recurrent carpal tunnel syndrome or in patients who may have distorted anatomy due to defects, fractures, or dislocations. Patients who are known to have neurological deficits in the thenar muscle area and near complete loss of sensory perception should have a fully

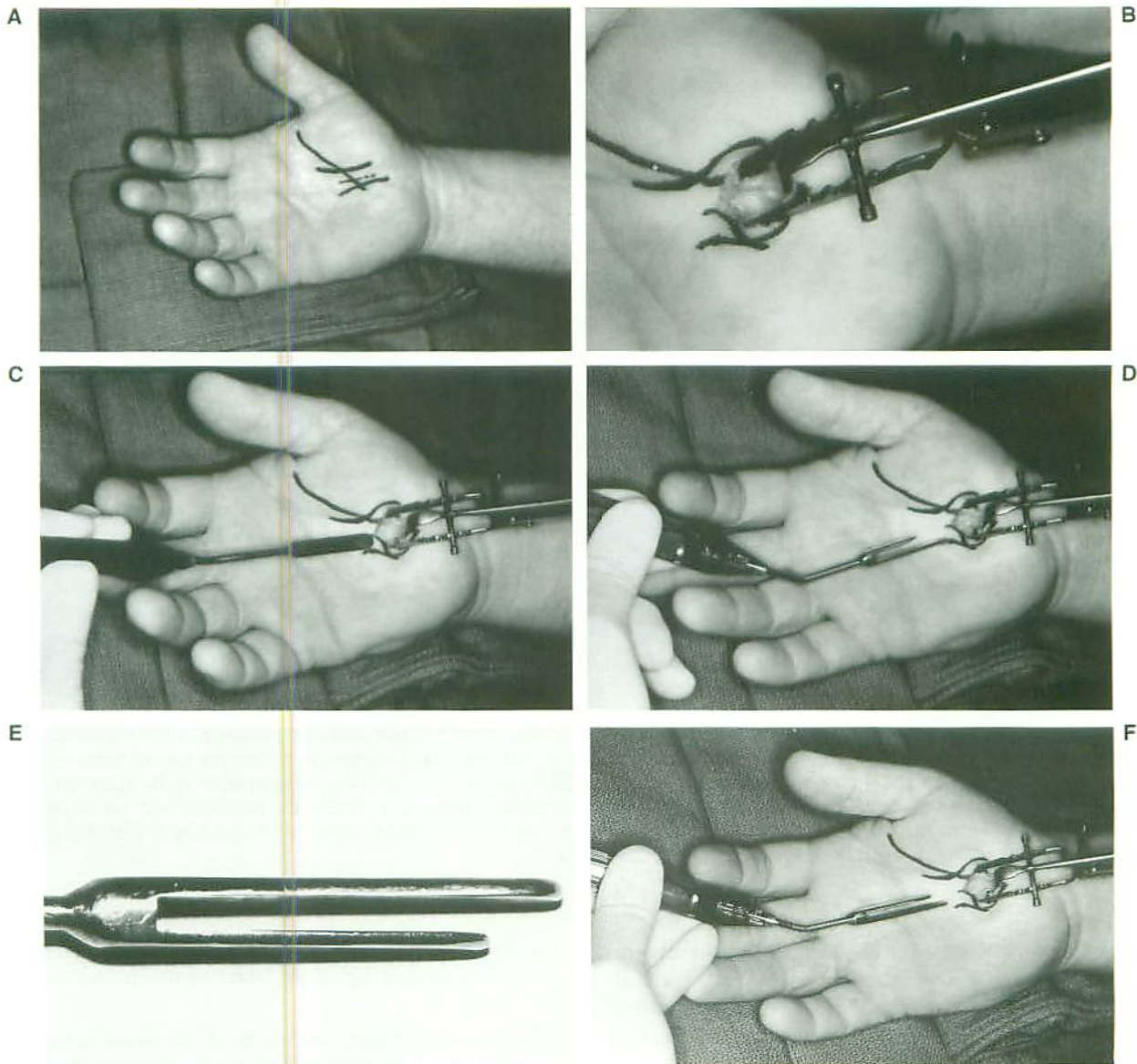
visualized exploration of the carpal canal with a conventional open carpal tunnel release.

If passing the cutting tome is difficult, the surgeon should never exert great force or “ram” the device across the transverse carpal ligament. Force can lead to the risk of perforating the ligament with the tome’s upper skid and may cut the median nerve. When the tome does not easily pass it is recommended that the incision be extended proximally for several centimeters, allowing separation of the ligament under direct vision. Hyperextension of the wrist as shown in cadaveric studies will aid in the zone of safety when using this device.

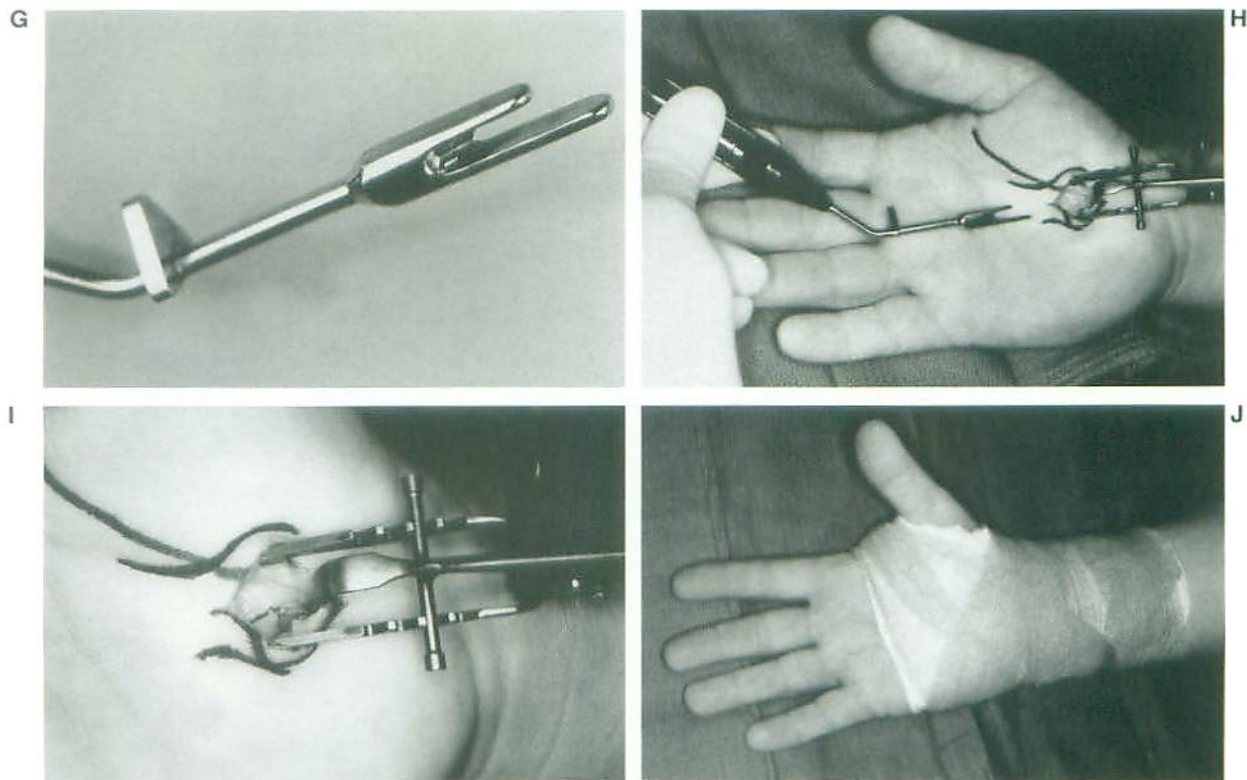
This technically simple procedure performed under local anesthesia requires only a few moments to perform, decreases tissue trauma, and preserves the superficial

**FIG. 7.** Division of the transverse carpal ligament by proximal passage of the carpal tunnel tome.





**FIG. 8.** **A:** Surgical landmarks drawn in the palm with the incision in line and proximal to the radial border of the ring finger. **B:** The self-retaining Holzheimer retractor is placed in the wound. **C:** The blunt pilot is placed in the depths of the wound between the underneath surface of the transverse carpal ligament and the contents of the carpal canal. **D:** The stripper is inserted into the notch created by the distal division of the ligament and its undersurface and is passed beneath the ligament under direct visualization. **E:** The double pilot instrument. **F:** The double pilot enters the V-notch created by the short incision of the distal ligament. This instrument straddles the ligament and is passed proximally to establish a pathway for the final passage of the carpal tunnel tome.



**FIG. 8.** **G:** The carpal tunnel tome with its triangular bumper on the stem to stop proximal passage of the instrument after it has divided the remaining 2.53 cm of the transverse carpal ligament. **H:** Insertion of the carpal tunnel tome into the V-notch created by the distal incision into the transverse carpal ligament with the two skids straddling the ligament. Use of the tome guide not shown is recommended. **I:** A proximal retractor placed to visualize the separation of the radial and the ulnar cut edges of the transverse carpal ligament, confirming its complete division. **J:** A soft tissue bulky dressing placed after successful division of the transverse carpal ligament.

palmar fascia, allowing for a quicker postoperative recovery. A mid-palm incision allows for a direct visualization of the neurovascular structures (intra-ligamentous motor branch). Our clinical experience with this device attests to the procedure efficacy.

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