Endoscopic carpal tunnel release has the advantage over open release of reduced tissue trauma and postoperative morbidity. Limited open carpal tunnel release has also been shown to have comparable results, but is easier to perform and is safer. We have compared the results of both techniques in a prospective, randomised trial. Thirty patients with bilateral carpal tunnel syndrome had simultaneous bilateral release. The technique of release was randomly allocated to either two-portal endoscopic release (ECTR) or limited open release using the Strickland instrumentation (LOCTR).

The results showed that the outcome was similar at follow-up of one year using both techniques. However, the LOCTR group had significantly less tenderness of the scar at the second and fourth postoperative week (p < 0.01). There was also less thenar and hypothenar (pillar) pain after LOCTR. Subjective evaluation showed a preference for LOCTR.

Patients and Methods

Between July 1999 and August 2000, 30 patients with bilateral idiopathic carpal tunnel syndrome were included in the study. The syndrome was diagnosed clinically according to symptoms and signs, including nocturnal pain, numbness, weakness and positive provocative tests. Reduced nerve conduction velocity (NCV) was confirmed in every case. Patients with diabetes mellitus, peripheral neuropathy, cervical radiculopathy, thoracic outlet syndrome or a previous injury or operation to the wrist were excluded as were workers’ compensation cases.

All patients had undergone conservative treatment without improvement. Simultaneous bilateral release was performed. The dominant hand was randomly allocated to either ECTR or LOCTR by using a random-number table and the opposite hand was treated using the other technique.

There were 28 women and two men with a mean age of 47 years (35 to 73). Seventeen were housewives, eight were manual workers and four non-manual workers. The duration of symptoms in the ECTR group was 4.2 ± 3.5 years and in the LOCTR group 5.0 ± 3.6 years (p = 0.06). The patients had similar symptomatology, signs and scores in the two-
point discrimination test, motor latency and sensory conduction velocity (Table I).

The preoperative range of movement, grip and pinch strength were recorded and postoperative measurements were expressed as a percentage of the preoperative values. Two-point discrimination was measured on the index finger and power and pinch grip were assessed at each follow-up. Postoperative pain in the wound was assessed using a visual analogue scale (VAS) of 0 to 10 points. The presence of pillar pain was assessed at each follow-up by questioning and the application of pressure over the thenar and hypothenar regions. Complications were recorded and patients’ preferred surgical technique was noted.

**Operative technique.** All the procedures were performed under intravenous regional block with a tourniquet placed over the proximal forearm and after 20 ml of 0.5% lignocaine had been injected intravenously in the forearm. A modified Chow technique18 (Fig. 1) was used for ECTR, and the method of Lee and Strickland17 for LOCTR (Fig. 2). The operations were performed by the authors or

### Table I. Comparison of preoperative symptoms and signs in both groups

<table>
<thead>
<tr>
<th></th>
<th>ECTR</th>
<th>LOCTR</th>
<th>p value</th>
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<tbody>
<tr>
<td><strong>Preoperative symptoms (%)</strong></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Numbness</td>
<td>96</td>
<td>93</td>
<td>0.55</td>
</tr>
<tr>
<td>Weakness</td>
<td>64</td>
<td>79</td>
<td>0.23</td>
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<tr>
<td>Pain</td>
<td>50</td>
<td>57</td>
<td>0.59</td>
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<tr>
<td><strong>Preoperative signs</strong></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Phalen sign (%)</td>
<td>86</td>
<td>86</td>
<td>1</td>
</tr>
<tr>
<td>Direct compression sign (%)</td>
<td>86</td>
<td>86</td>
<td>1</td>
</tr>
<tr>
<td>Tinel sign (%)</td>
<td>50</td>
<td>68</td>
<td>0.17</td>
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<tr>
<td>Wasting of abductor pollicis brevis (%)</td>
<td>39</td>
<td>50</td>
<td>0.42</td>
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<tr>
<td>Weakness of abductor pollicis brevis (%)</td>
<td>29</td>
<td>29</td>
<td>1</td>
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<tr>
<td>Moving 2-point discrimination (mm)</td>
<td>3.9 ± 1.7</td>
<td>4.2 ± 2.3</td>
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<tr>
<td><strong>Neurophysiological studies</strong></td>
<td></td>
<td></td>
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<tr>
<td>Distal motor latency (ms)</td>
<td>6.5 ± 3.1</td>
<td>6.7 ± 3.7</td>
<td>0.62</td>
</tr>
<tr>
<td>Sensory conduction velocity (m/s)</td>
<td>29.6 ± 20.6</td>
<td>27.9 ± 18.2</td>
<td>0.32</td>
</tr>
</tbody>
</table>

Fig. 1
Photographs of the modified two portals endoscopic release showing A) the portals marked on the skin, B) the passage of the cannula through the portals, C) the passage of the knife from the proximal end and the videoscope through the distal end and D) a video view of the knife dividing the flexor retinaculum; the edges of the slot in the cannula are marked by arrows.

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under their supervision. Division of the transverse carpal ligament was confirmed using a probe.

**Modified Chow two-portal endoscopic release technique.**
The standard Chow two-portal technique is used with some modifications. At the proximal portal, the ulnar bursa is identified, and the plane between it and the deep aspect of the transverse carpal ligament is developed (extrabursal approach). After the cannula and videoscope has been introduced, it is important to identify the distal border of the transverse carpal ligament. Instead of the original description of using three types of knife to divide the transverse carpal ligament in steps, we use only the retrograde hook knife. This is introduced through the proximal portal and hooks the distal border of the transverse carpal ligament. Its passage through the ligament is monitored on the video.

**Limited open carpal tunnel release (Lee and Strickland).**
The distal border of the transverse carpal ligament is palpated and marked on the palm. With the fingers together, a longitudinal line is drawn from the radial border of the ring finger towards the heel of the hand and its intersection with the distal border of the transverse carpal ligament is marked. The incision is made along this longitudinal line, starting approximately 0.5 cm distal to the distal border of the transverse carpal ligament extending proximally for about 1.5 cm (Fig. 2b). The palmar aponeurosis is identified by its longitudinal fibres and is divided over the length of the incision. The transverse carpal ligament and its distal border is identified by its transverse fibres. A set of three specially designed strippers (Biomet, Warsaw, Indiana) (Fig. 2a) is used. The first is a simple blunt-tipped instrument which is passed beneath the ligament to separate any structures from its undersurface. The second is a double-pronged palmar stripper. The upper prong is shorter and has a tapered tip. The two prongs are passed superficial and deep to the ligament. The third stripper has two long blunt prongs. This is used to develop further the space superficial and deep to the ligament. It straddles the ligament and is passed into the distal forearm where it can be palpated (Fig. 2c). A small cut is made in the distal border of the ligament in order to engage the blade of the front cutting knife, the ‘Indianatome’. The knife is advanced through the length of the ligament (Fig. 2d). The completeness of the division of the ligament can be confirmed by elevating the skin with a retractor, or by passing a MacDonald dissector into the carpal tunnel.

**Postoperative management.** The length of the wound which was used for both methods was recorded. Mobilisation exercises for the hand and wrist were started as soon as comfort permitted. The patients were reviewed at 2, 4, 8 and
16 weeks and at 6 and 12 months after surgery. Wound and pillar pain were assessed. Two-point discrimination power and pinch grip were measured at 4 and 12 weeks and at 6 and 12 months. Complications were recorded.

Statistical analysis. This was performed using standard statistical computer software (SPSS 9.0). The chi-squared test and Fisher’s exact test were used to compare categorical data. Parametric and non-parametric data were compared on a matched-pair basis by using the paired t-test and the Wilcoxon signed-rank test, respectively. A p value of < 0.05 was considered to be significant.

Results

All patients tolerated simultaneous bilateral surgery under forearm intravenous anaesthesia. The mean operating time was 12.9 ± 4.9 minutes for ECTR and 12.9 ± 5.1 minutes for LOCTR (p = 0.96). The mean length of the wound was 14.6 ± 2.1 mm and 15.4 ± 1.7 mm, respectively (p = 0.16) (Table II).

Efficacy of the procedure. After one year, 17 hands (57%) with ECTR and 19 (63%) with LOCTR had complete resolution of symptoms; 33% and 27%, respectively, had minimal residual symptoms and 10% and 6.7% had no change or only partial relief. These differences were not statistically significant (Table II).

Sensory recovery recorded by two-point discrimination showed similar results in both groups (Fig. 3). Power and pinch grip returned to their preoperative values at about three months in most patients and further improvement continued to the end of the first year (Fig. 4). Although the hands which had undergone LOCTR had slightly better strength than those which had had ECTR, the difference was not statistically significant. Functional recovery improved steadily and was comparable in both groups.

Postoperative pain. The pain in the wound measured with the VAS decreased. It was significantly less in the LOCTR
group (mean score 2.5 and 1.5) than in the ECTR group (mean score 3.3 and 2.5) at the second and fourth week (p = 0.004 and 0.008, respectively) (Fig. 5). Radial and ulnar pillar pain was also less in the LOCTR group. At eight weeks, 16 hands (53%) in the ECTR group and eight (27%) in the LOCTR group had radial pillar pain and 16 (53%) and ten (33%), respectively, had ulnar pillar pain (p = 0.03) (Fig. 5b). However, at other intervals of time, the difference was not statistically significant. There was also an improvement of pillar pain with time so that after one year few patients had such pain.

Safety of the procedure. There were no serious complications with either method with no wound infections, haematomas, neurovascular or tendon injuries. Trigger finger occurred in three hands in both groups. All resolved after physiotherapy or injection of steroid.

There was no recurrence of the carpal tunnel symptoms. There was a patient preference towards LOCTR especially during the early postoperative period (p = 0.04 at the eighth week) (Fig. 6). For those patients who preferred LOCTR, 75% felt that there was less pain.

Discussion
Carpal tunnel surgery, in general, gives satisfactory results regardless of technique. Less postoperative pain and faster recovery has been reported following endoscopic release when compared with an open technique.6,10,11 However, complications have been reported following endoscopic release.10,12-14 In an attempt to minimise the trauma of open carpal tunnel release, Lee and Strickland17 described using specially designed instruments and a smaller palmar incision of 1.5 cm in length, and they obtained similar results as after ECTR, and with few complications.

In a study comparing single portal endoscopic release versus small-incision open release, it has been shown that
within the first four weeks after surgery, patients had better pinch and grip strength after endoscopic release.\textsuperscript{19} The single portal endoscopic approach does not involve a wound in the palm which might account for the better performance, but the ‘short incision’ used was 2.5 cm long, which was longer than that used in the instrument-assisted, mini-open release of Lee and Strickland (1.5 cm). In our study, we also compared the incidence of pillar pain, which has not been previously addressed. It has been claimed that by leaving the palmar aponeurosis intact, patients who undergo ECTR should have less pillar pain.

We studied patients with bilateral carpal tunnel syndrome, as this allowed a direct comparison of outcome and preference. A recent report has compared the results of single portal endoscopic release using the Agee technique with conventional open release in patients with bilateral carpal tunnel syndrome.\textsuperscript{19} Grip strength, hand function, sensory improvement and patient satisfaction were determined. The results did not show any advantage of the endoscopic technique over conventional open release, but the problem of pillar pain was not addressed.

In our study both wrists of the patients had a similar degree of clinical and electrophysiological involvement of the median nerve. The outcome was similar after surgery, with complete or significant relief of symptoms in 90% for either procedure after one year and these results are similar to previous reports on the outcome after either procedure.\textsuperscript{6,10,11,18}

Despite the similarity in the total length of the wound (p = 0.16), patients after LOCTR had significantly less pain in the wound at the second and fourth postoperative weeks (p = 0.004 and p = 0.008, respectively). This differs from previous studies.\textsuperscript{19,20} We used the two-portal endoscopic technique. The proximal entry portal wound caused some pain initially when the wrist was moved. Contrary to expectation, the amount of pillar pain was significantly less after LOCTR, although the difference was not significant after one year. It was initially thought that there should be less pillar pain after ECTR as the palmar aponeurosis is preserved. This was not substantiated by our study. The cause of pillar pain will require further studies. These findings were consistent with the patients’ preference of surgical procedure; 53% preferring LOCTR when assessed at the end of eight weeks.

There was no major complication after either procedure in this study. The complication rate of either procedure should be less than 1%.\textsuperscript{17,18} However, LOCTR is easier to perform than ECTR, and does not require any special endoscopic equipment. The incision of LOCTR is placed over the distal part of the transverse carpal ligament and avoids the heel of the palm. It allows direct inspection of the contents of the carpal tunnel. The superficial palmar arch can be safeguarded and any local lesion can be identified. If necessary the exposure can be extended or converted to a classical open release for additional procedures to be carried out. Thus, LOCTR combines the simplicity and safety of open release with reduced tissue trauma and avoids the potential serious complications of endoscopic release.

No benefits in any form have been received or will be received from a commercial party related directly or indirectly to the subject of this article.

References