INTRODUCTION
Carpal tunnel syndrome (CTS) is the most common neuropathy of the upper limbs in the world. The prevalence of CTS in the general population has been studied in several countries, with reports ranging from 2.7 – 5.8%.1,2 It is a condition of middle-aged women, increasing gradually with age.3 CTS is a cause of pain, numbness in hand and work disability.1 Physical examination, history, and electromyography (EMG) results must be evaluated for the diagnosis of CTS. It can be managed with conservative treatment including medicine, local steroid injections and hand braces.4 Surgical treatment is required in patients with moderate and severe symptoms. Surgical treatment seems to be more effective than splinting or anti-inflammatory agents plus hand therapy in the midterm and long-term treatments of CTS.5 Standard open carpal tunnel release (CTR) makes use of a longitudinal skin incision directly over the transverse carpal ligament (TCL) and has given consistent results.6 However, this procedure is associated with complications including scar, thenar and hypothenar pain and weakness of pinch and grip, which are difficult to treat.7 Lately, endoscopic procedures for CTR have been introduced with the presumed advantage of decreased postoperative pain and subsequently faster return of patients to work.8 But, endoscopic CTR is technically demanding, needs sophisticated instruments and has a steep learning curve.9 A number of surgical techniques are also described in the literature. The aim of this study was to evaluate the effectiveness of mini-transverse compared with mini-longitudinal incision for carpal tunnel release (CTR) with reference to postoperative functional capacity, symptom severity and complication rate.

METHODOLOGY
This comparative study was carried out at Cumhuriyet University, Medical Faculty, Department of Orthopaedics, Tokat State Hospital, Department of Orthopaedics and Medical Park Tokat Hospital, Department of Neurosurgery, from January 2007 to January 2009. CTR was performed to total 93 wrists of 79 patients with CTS. Exclusion criterias were as follows: (a) the patients

ABSTRACT
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Methodology: This study included 93 hands of 79 patients with carpal tunnel syndrome (CTS), which were operated between 2007 and 2009. Patients were divided according to incision types into Group-1 (undergoing mini-longitudinal incision) and Group-2 (undergoing mini-transverse incision). Patients were evaluated initially and at 3 weeks after treatment according to symptom severity and functional status of Boston Questionnaire (BQ). Demographic and clinical data were analyzed and compared statistically between two groups.
Results: Statistically significant differences were observed in BQ symptom and functional scores between the pre- and postoperative period (p < 0.0001). BQ symptom and functional scores at postoperative period were better in Group-1 than Group-2 (p = 0.044 and p = 0.023 respectively). The scar hypersensitivity (p = 0.258) and tenderness (p = 1.00) associated with the incision sites were not statistically different.
Conclusion: Longitudinal incision is more effective on symptom and functional conditions than transverse incision. However, there was less scar formation with transverse incision.

Key Words: Carpal tunnel syndrome. Mini-incision. Carpal tunnel release.

ORIGINAL ARTICLE

Mini Transverse Versus Longitudinal Incision in Carpal Tunnel Syndrome
Murat Korkmaz1, Mehmet Ali Ekici2, Mehmet Cengiz Çepoglu3 and Hayati Öztürk4

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suffered from systemic diseases (diabetes mellitus, renal disease, rheumatoid disease, wrist fracture, tenosynovitis, and mass lesion), (b) associated with entrapment neuropathies disease, (c) early and mild EMG severity. All of them had a diagnosis of CTS according to history, physical examination and pre-operatively EMG results (Table I). Group-1 consisted of 38 patients, which were operated with mini-longitudinal incision technique. Group-2 included 41 patients, which were operated with a mini-transverse incision technique. All patients were assessed before surgery and at 3 weeks after treatment according to symptom severity and functional capacity via using Boston Questionnaire (BQ). The symptom and functional conditions of the patients were recorded by accessing the phones or calling for control. Patients were draped under sterile conditions following injection of local anaesthetic agent to wrist area. A tourniquet was not used. In mini-longitudinal incision technique group, 2 – 3 cm incision was given to the ulnar side of the palmaris longus, above the flexor crease of the wrist. TCL was identified and a clamp, was shocked between the median nerve for protection. TCL was cut with a surgery scissors, beginning through the incision from proximal to distal. Carpal tunnel was decompressed from the antebrachial fascia (Figure 1). Bleeding was checked. The incisions were closed with interrupted mattress sutures (3-0 / 4-0 non-absorbable material). A bandage was used post-operatively.

In Group-2, an ideal hand position was obtained with a 30 degree wrist dorsiflexion. Two cm transverse incision was made from the distal palmar crease across ulnar to the palmaris longus tendon. The palmaris longus tendon was stayed laterally in the area. TCL was found and cut with surgical scissors, in protecting the median nerve. Carpal tunnel was decompressed from the distal end of the TCL (Figure 2). Bleeding problems were not encountered. This incisions were sutured with 3-0 or 4-0 non-absorbable material. A bandage was used postoperatively. Most surgeons avoid transverse palmar incisions because of inadequate exposure and potential injury to the palmar cutaneous nerve branch of the median nerve.

Statistical analysis was performed using Statistical Package for Social Sciences (SPSS) version 18.0 software package (version 18, SPSS Inc. Chicago, IL, USA). Parameters were expressed as mean ± SD or as a percentage. The Fisher’s exact test was used to compare categorical data. In incision groups, pre-operative and postoperative parameters, BQ symptoms and functional scores were evaluated by using t-test. Statistical significance was set at p < 0.05.

RESULTS

Ninety three hands of 79 patients with CTS were operated. Demographic and clinical data of the groups are shown in Table I.

The mean values of pre-operative and postoperative BQ symptom severity scores in Group-1 patients were 34.4 ± 5.6 and 12.9 ± 2.7 respectively (p < 0.0001) and 35.9 ± 4.4 and 14.0 ± 2.3 respectively (p < 0.0001) in Group-2 patients.

Table I: The distribution of demographic and clinical data of the study subjects.

<table>
<thead>
<tr>
<th></th>
<th>Mini-longitudinal incision Group-1 (n = 38)</th>
<th>Mini-transverse incision Group-2 (n = 41)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age, mean y, (SD)</td>
<td>53 (11.8)</td>
<td>54 (11.8)</td>
</tr>
<tr>
<td>Women, n (%)</td>
<td>28 (73.7)</td>
<td>36 (87.8)</td>
</tr>
<tr>
<td>Bilateral CTS, n (%)</td>
<td>7 (7.2)</td>
<td>7 (7.8)</td>
</tr>
<tr>
<td>Positive Phalen’s test, n (%)</td>
<td>25 (65.8)</td>
<td>20 (48.8)</td>
</tr>
<tr>
<td>Positive Tinel’s test n (%)</td>
<td>22 (57.9)</td>
<td>23 (56.1)</td>
</tr>
<tr>
<td>Atrophy of thenar, n (%)</td>
<td>12 (31.6)</td>
<td>16 (39.0)</td>
</tr>
<tr>
<td>Pre-operative EMG severity n (%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Moderate</td>
<td>14 (36.8)</td>
<td>18 (43.9)</td>
</tr>
<tr>
<td>Severe</td>
<td>24 (63.2)</td>
<td>23 (56.1)</td>
</tr>
<tr>
<td>Return to daily activities mean (SD)</td>
<td>15 (1.4)</td>
<td>12.25 (1.09)</td>
</tr>
</tbody>
</table>

n = the number of people; y = year

Figure 1: Mini-longitudinal incision.

Figure 2: Mini-transverse incision.
Table II: Statistical analysis.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Mini-longitudinal incision (Group-1) nw (%) / Mean ± SD</th>
<th>Mini-transverse incision (Group-2) nw (%) / Mean ± SD</th>
<th>Difference Group-1 - Group-2 p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>BQ symptom severity</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pre-operative</td>
<td>45 (100) / 34.4 ± 5.6</td>
<td>48 (100) / 35.9 ± 4.4</td>
<td>=0.1651</td>
</tr>
<tr>
<td>Postoperative</td>
<td>45 (100) / 12.9 ± 2.7</td>
<td>48 (100) / 14.0 ± 2.3</td>
<td>=0.0441</td>
</tr>
<tr>
<td>p-value</td>
<td>&lt; 0.00011</td>
<td>&lt; 0.00011</td>
<td></td>
</tr>
<tr>
<td>BQ function condition</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pre-operative</td>
<td>45 (100) / 29.5 ± 5.3</td>
<td>48 (100) / 31.5 ± 5.7</td>
<td>=0.0911</td>
</tr>
<tr>
<td>Postoperative</td>
<td>45 (100) / 10.9 ± 2.3</td>
<td>48 (100) / 12.2 ± 2.3</td>
<td>=0.0231</td>
</tr>
<tr>
<td>p-value</td>
<td>&lt; 0.00011</td>
<td>&lt; 0.00011</td>
<td></td>
</tr>
<tr>
<td>Scar tenderness</td>
<td>2 (5.1)</td>
<td>2 (4.9)</td>
<td>=1.0002</td>
</tr>
<tr>
<td>Scar hypersensitivity</td>
<td>5 (12.8)</td>
<td>2 (4.9)</td>
<td>=0.2582</td>
</tr>
</tbody>
</table>

BQ: Boston Questionnaire; nw: number of wrist; 1 = t-test; 2 = Fisher’s exact test

The mean pre-operative and postoperative BQ symptom and functional condition scores in Group-1 patients were 29.5 ± 5.3 and 10.9 ± 2.5 (p < 0.0001) and as 31.5 ± 5.7 and 12.2 ± 2.3 (p < 0.0001) in Group-2 patients respectively. Significant statistical differences were observed in either BQ symptom and functional scores between the pre- and postoperative period (p < 0.0001 for both). The pre-operative and postoperative BQ symptom and functional scores were shown in Table II. Group-1 postoperative BQ symptom and functional scores were better than Group-2 (p = 0.044 and p = 0.023 respectively).

Scar tenderness was seen in 2 patients each in both groups. Scar hypersensitivity occurred in 5 patients of Group-1 and 2 patients of Group-2. The scar hypersensitivity and tenderness associated with the incision sites were not statistically different between both incision types (p = 0.258 and p = 1.000 respectively).

In the follow-up period, neither recurrence nor pillar pain or neuro-vascular injury were detected in either group.

**DISCUSSION**

At present, many authors prefer the mini-incision technique for surgical release of the TCL.11 Because, endoscopic techniques have a long learning curve, contain high complication rates, and need expensive equipment.12 In this study, two different mini-incision trails were used for CTS treatment. Longitudinal incision was found to be statistically more effective regarding symptom and functional conditions than mini-transverse incision. However, scar formation was lesser in mini-transverse incision.

Open technique has a wide exposure with advantage of crucial anatomical structures sparing as well as direct visualization. However, there are some disadvantages associated with this technique such as pillar pain, tender scars and delayed return to work.13 Kluge et al. operated with open technique on 89 hands. Scar formation rate was 19% in the affected hands and pillar pain rate was 4%. Hypoesthesia rate on the scar area was 7%. In 18% of the cases, there was incomplete relief of primary symptoms.14

Alternative techniques have been developed with the intent to reduce complications. The endoscopic technique is shown to be valuable with advantages such as small scar, less postoperative pain, rapid postoperative recovery and preservation of grip strength. Serra et al. presented the results obtained in 112 patients during one-year follow-up period. Complaints about tenderness of the scar stopped, and by the end of the study, patients had regained 126% of their preoperative grip strength. All patients were able to use their hands shortly after the operation, and after 3 weeks, all of them returned to work.15 The disadvantages are the impossibility of a direct median nerve neurolysis and a higher surgical complication rate, including injury to the median nerve.16,17 One article reported a complete laceration of the flexor digitorum profundus tendon of the middle finger following endoscopic CTR.18 Some aspects such as availability of equipment, need of disposable items for some techniques with impact on direct costs and need of training with endoscopic equipment preclude their application in some environments, specially where low budget is a reality.9 In this study, no nerve injury was observed in either groups.

Recently, mini-open techniques can be viewed as an alternative to endoscopic techniques. Cirpar et al. evaluated CTR with a 3 cm limited incision technique to be effective and safe when compared with classical open and endoscopic techniques.19 In another study, the safety and effectiveness of mini-incision and a limited open techniques were prospectively compared for CTR in 185 consecutive patients, which were operated with a 5 years minimum period of follow-up. Patient status was evaluated with BQ. Mini-incision for CTR showed that advantages were in early recovery, low pillar pain, and low recurrence rate.20 Bal et al. compared the results of 27 patients who underwent surgery for CTS and evaluated the patients in two groups according to the site of the mini-incision performed for surgical release. Both methods of CTR yielded satisfactory results in the mid and long-term follow-up and low incision related morbidity.21 In another study, clinical experiences related
to mini-incision technique in two centres consisted of 694 hands over a 29-month period were reported. A great majority of patients derived complete 72.6% or near-complete 19.6% symptomatic relief from the procedure.\textsuperscript{12} In patients with mini-longitudinal incision release, less postoperative symptoms and improved functional status were seen compared with mini-incision transverse release.

**CONCLUSION**

Mini-longitudinal incision was statistically more effective for symptoms and functional improvement in CTS than mini-transverse incision. However, the frequency of scar formation was lower with mini-transverse incision.

**REFERENCES**