

# Dual-portal endoscopic release in carpal tunnel syndrome

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## ABSTRACT

**Objective:** To evaluate the outcomes of endoscopic release of the transverse carpal ligament (TCL) in carpal tunnel syndrome (CTS) using the Chow dual-portal technique between January 2006 and December 2015. **Materials and Methods:** Study population consisted of 217 cases of idiopathic CTS, in 179 patients, 145 females (81%) (31 bilateral cases) and 34 males (19%) (7 bilateral cases), with an average age of 48.2 years (range, 32-68) and an average follow-up of 97.9 months. The symptom severity and functional evaluations were performed using the Boston Carpal Tunnel Questionnaire Symptoms Severity Scale (BCTQ-SSS) and the Functional Status Scale (BCTQ-FSS). **Results:** The average BCTQ-SSS was 3.20±0.26 in the preoperative period, which improved to 1.30±0.12 at the 6-month postoperative follow-up and remained at 1.25±0.11 in the long-term. The average BCTQ-FSS was 2.57±0.29 in the preoperative period, which improved to 1.28±0.12 at the 6-month postoperative follow-up and remained at 1.20±0.09 in the long-term. There were 7 cases (3.2%) of transient postoperative neuropathia. No patient required to be converted to open technique. **Conclusion:** The endoscopic carpal tunnel release with Chow technique is an effective and safe surgical method for the treatment of idiopathic CTS.

**Key words:** Carpal tunnel syndrome; Chow dual-portal technique; endoscopic release; neural compression; median nerve.

**Level of Evidence:** III. Historical cohort study

## Retinaculotomía endoscópica de doble portal en el síndrome del túnel carpiano

### RESUMEN

**Objetivo:** Evaluar los resultados de la retinaculotomía endoscópica para tratar el síndrome del túnel carpiano mediante la técnica de doble portal de Chow, entre enero de 2006 y diciembre de 2015. **Materiales y Métodos:** Estudio de 179 pacientes (edad promedio 48.2 años [rango 32-68]), con 217 casos de síndrome del túnel carpiano idiopático y un seguimiento promedio de 97.9 meses. Los pacientes (145 mujeres [81%]) (31 bilaterales) y 34 hombres (19%) (7 bilaterales) fueron evaluados con la *Symptom Severity Scale* (SSS) y la *Functional Status Scale* (FSS) del *Boston Carpal Tunnel Questionnaire* (BCTQ). **Resultados:** El puntaje medio de la SSS-BCTQ fue de 3,20 ± 0,26 antes de la cirugía, mejoró a 1,30 ± 0,12 a los 6 meses y se mantuvo en 1,25 ± 0,11 a largo plazo. El puntaje medio de la FSS-BCTQ fue de 2,57 ± 0,29 antes de la cirugía, mejoró a 1,28 ± 0,18 a los 6 meses y se mantuvo en 1,20 ± 0,09 a largo plazo. Hubo 7 casos (3,2%) de neuropatía posquirúrgica transitoria. No hubo conversiones a técnica abierta. **Conclusión:** La liberación endoscópica del túnel carpiano con la técnica de Chow es un método quirúrgico eficaz y seguro para tratar el síndrome del túnel carpiano idiopático.

**Palabras clave:** Síndrome del túnel carpiano; técnica de doble portal de Chow; liberación endoscópica; compresión neural; nervio mediano.

**Nivel de Evidencia:** III

## INTRODUCTION

CTS is the most common compressive peripheral neuropathy, affecting up to 3% of the general population, with a female predominance.<sup>1</sup> The first described case of CTS was published by Paget in 1854, and the first CTS surgical release was published by Learmonth in 1933.<sup>2,3</sup> Since then, all CTS surgical techniques aim to achieve median nerve decompression by dissecting the TCL.

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**How to cite this paper:** Ojeda AC, Contreras VA, Sanzana ES. Dual-portal endoscopic release in carpal tunnel syndrome. *Rev Asoc Argent Ortop Traumatol* 2020;85(4):349-356. <https://doi.org/10.15417/issn.1852-7434.2020.85.4.1062>

For the past 50 years, open carpal tunnel release (OCTR) has proven to be an effective surgical procedure for patients with CTS refractory to nonoperative measures and persistent symptoms.<sup>4</sup> However, OCTR is associated with some potential complications, including lesion on the left palmar cutaneous branch of the median nerve, residual pillar pain, and scar tenderness.<sup>5,6</sup>

In order to prevent OCTR complications, during the 1990s the study and development of endoscopic TCL release procedures emerge, in hand with the simultaneous publications in 1989 of Okutsu's single-portal technique and Chow dual-portal technique.<sup>7,8</sup> Other surgical teams then began to ratify and build on the work of these pioneers, actively developing endoscopic techniques, both single- and dual-portal techniques, with a special mention to those of Agee *et al.* and Brown *et al.*, who concurrently but independently published their respective experiences in 1992.<sup>9,10</sup>

The cumulative evidence has shown that endoscopic TCL release in CTS patients has a long-term clinical safety and effectiveness equivalent to the OCTR while also providing the initial benefit of less postoperative pain. However, 3 months after the CTS surgical treatment, OCTR and endoscopic outcomes become similar and remain without significant differences regarding symptom severity and functional status scores in the long-term.<sup>11-16</sup>

The objective of this historical cohort study is to report our experience with the Chow dual-portal technique in idiopathic CTS patients.<sup>17</sup>

## MATERIALS AND METHODS

Over the decade between January 2006 and December 2015, 224 patients with idiopathic CTS refractory to non-operative treatments were operated on using the Chow dual-portal endoscopic release technique. From the entire population of patients undergoing endoscopic surgery, we were able to conduct a study and a long-term follow-up of 179 patients, whose results are presented in this report.

We conducted a historical cohort study of 179 patients, comprising 217 cases of idiopathic CTS, with an average age of 48.2 years (range, 32-68). Study population consisted of 145 females (81%), 174 CTS cases (31 bilateral), and 34 males (19%), 41 CTS cases (7 bilateral). The affected hand was the right in 104 patients, the left in 37, and both in 38. All cases were preoperatively assessed by ultrasonography and electromyography, and bilateral CTS patients underwent a single bilateral procedure.<sup>14,18</sup>

Patients were discharged 6 hours after surgery and had to return for follow-up visits every week during the first month and every month during the first 6 months, with a final long-term follow-up control. Patients were evaluated using the BCTQ-SSS and BCTQ-FSS, two independent sub-scaled of the Boston Carpal Tunnel Questionnaire (BCTQ) developed by Levine. The BCTQ-SSS consists of 11 questions, which answers are rated from 1 to 5 points, and its score is calculated as the mean of all answers. The BCTQ-FSS consists of 8 questions, which score is also calculated as the mean of all answers 8 answers, rated from 1 to 5 points.<sup>19</sup> The statistical analysis consisted of a descriptive analysis of each variable, describing qualitative variables as absolute and relative percentage frequencies and quantitative variables as mean and standard deviation.

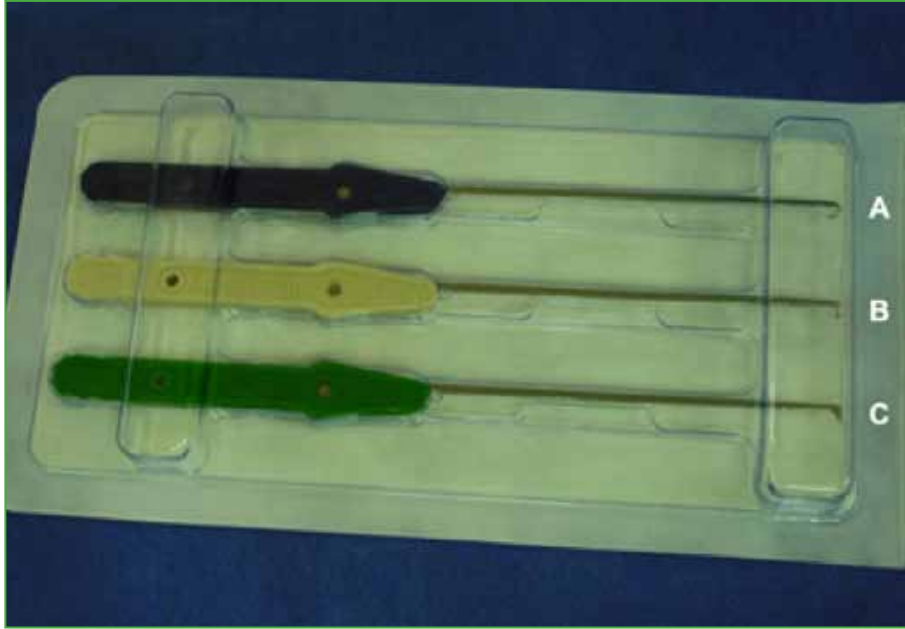
## Surgical Technique

Patients were placed in the supine position, without pneumatic tourniquet, and with the upper limb on a hand table. Surgeon and assistant place themselves facing each other, with the surgeon on the ulnar side of the patient. The procedure consists of a dry endoscopic approach that requires the ECTRA II System Kit designed by Chow (Smith & Nephew Endoscopy, Andover, MA, USA). The system includes a 4mm × 30° video-endoscope, Ragnell retractors, a slotted cannula, a curved blunt dissector, obturators, a probe, a hand holder, and a disposable kit that includes a probe knife, a triangle knife, and a retrograde knife (Figure 1).

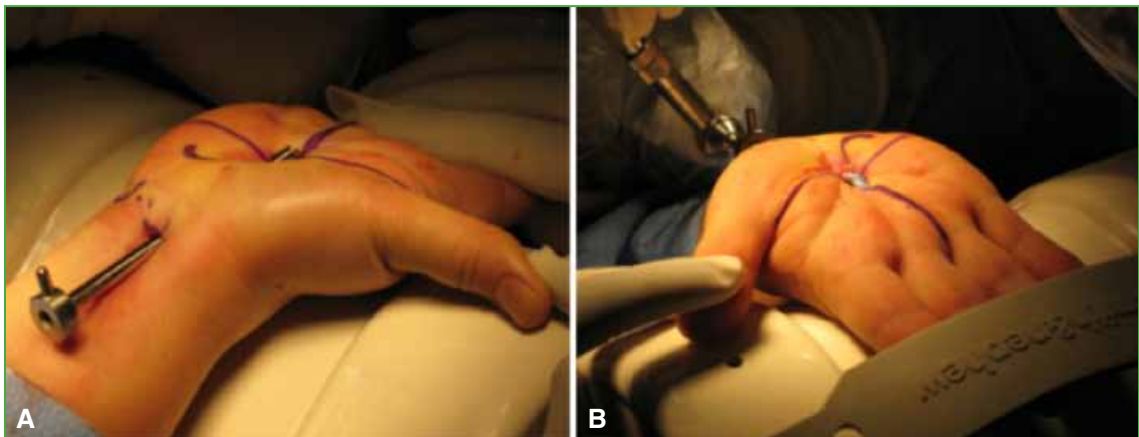
Standard hand preparation is performed, with landmark drawings for the hook of the hamate, the pisiform, the palmaris longus tendon, and the endoscopic portals. The proximal portal is established 1-2cm radial to the proximal end of the pisiform bone and ulnar to the palmaris longus tendon. A distal portal is established 1cm proximal to the intersection of a longitudinal line along the ulnar border of the middle finger and a transverse line along the abducted thumb. Local anesthetic infiltration using 1.5% lidocaine (3mL= 45mg) is injected in both portals. Sedation is administered using 1% propofol continuous infusion (Fresenius-Kabi, Germany).<sup>20</sup>

Surgery begins with a 5mm incision, at the proximal portal site, then the proximal edge of the TCL is identified, the curved blunt dissector is inserted through an infraretinacular corridor of the carpal tunnel until it emerges at the distal portal site, and the slotted cannula and video-endoscope are placed (Figure 2).

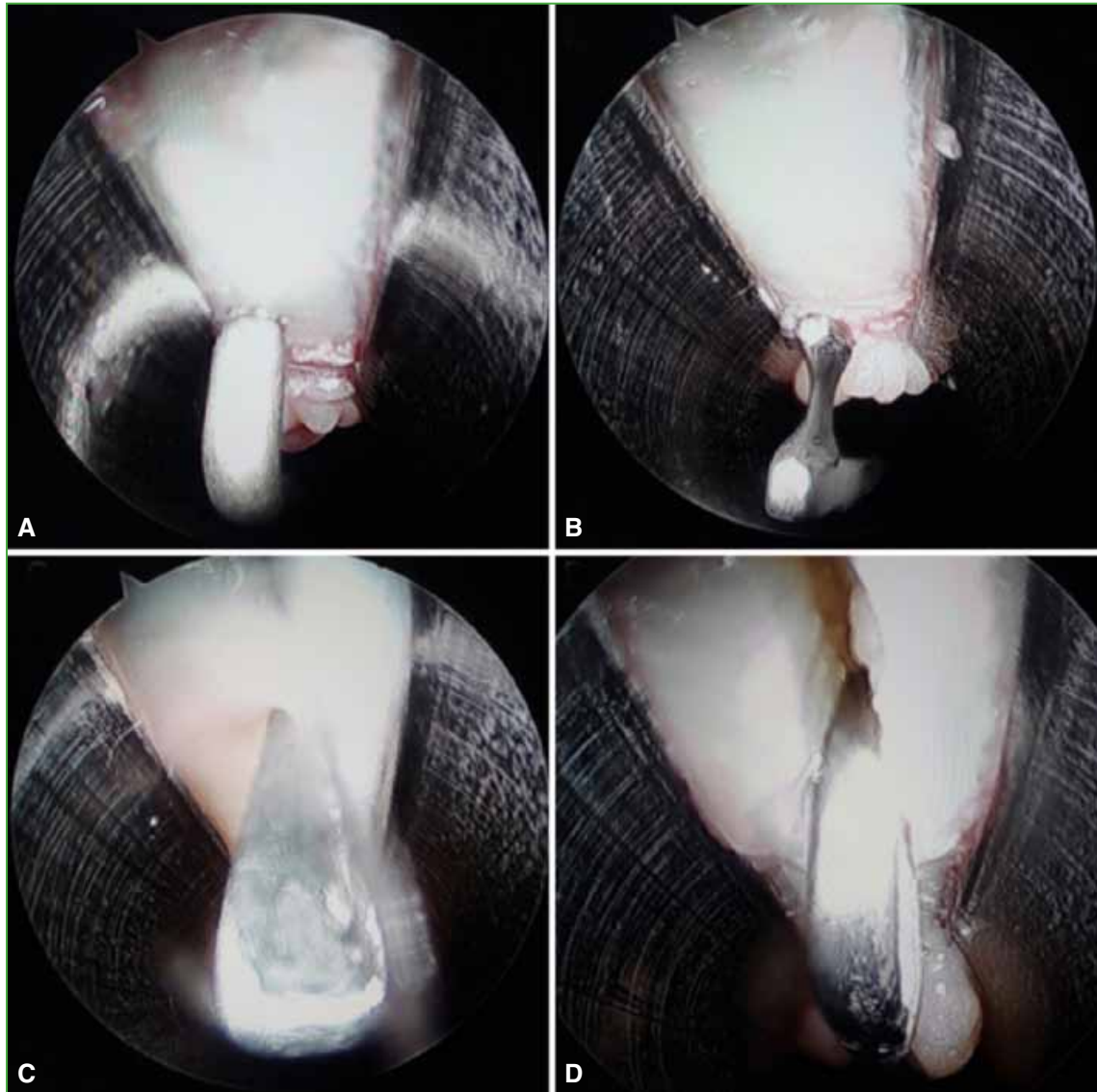
The TCL can be visualized and palpated with instrumentation, and then resected with the consecutive use of the probe, triangle, and retrograde knives. Finally, skin sutures with single stitches are applied in the proximal and distal portals (Figure 3).



**Figure 1.** Disposable kit of the Chow ECTRA II System (Smith & Nephew Endoscopy, Andover, MA, USA): A. retrograde knife; B. probe knife; C. triangle knife.



**Figure 2.** Image of a patient undergoing surgery with the Chow dual-portal endoscopic release technique showing: A. Slotted cannula placed in the carpal tunnel. B. Dry endoscopy of the transverse carpal ligament using a small video-endoscope.

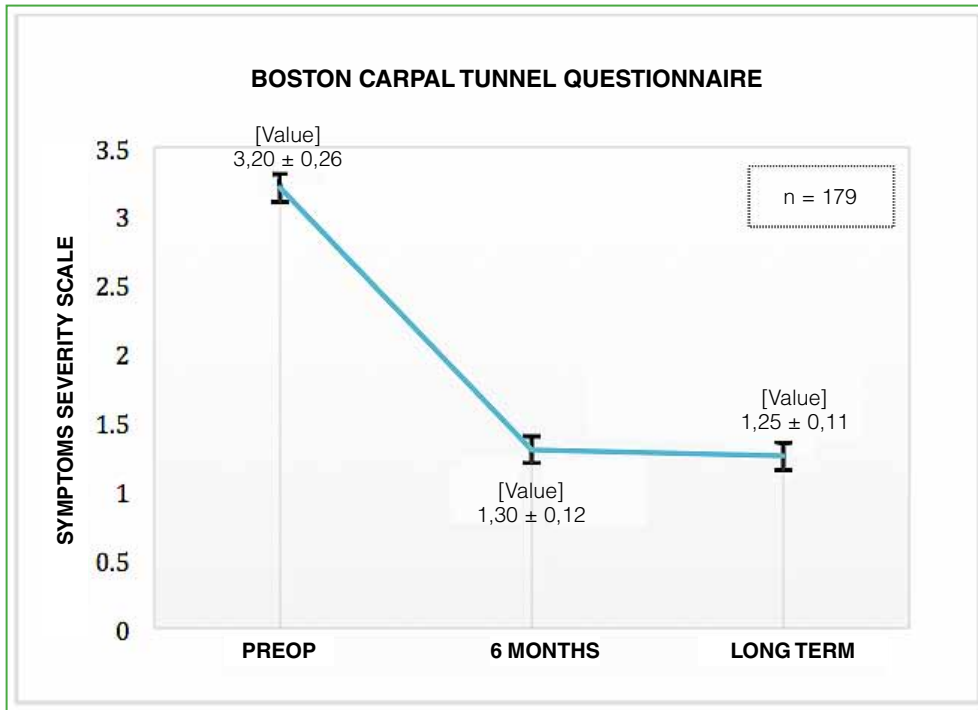


**Figure 3.** Image of the endoscopic transverse carpal ligament release in a patient with idiopathic carpal tunnel syndrome showing: **A.** Probe at the transverse carpal ligament level. **B.** Use of the probe knife. **C.** Use of the triangular knife and **D** Ligament dissection using the retrograde knife.

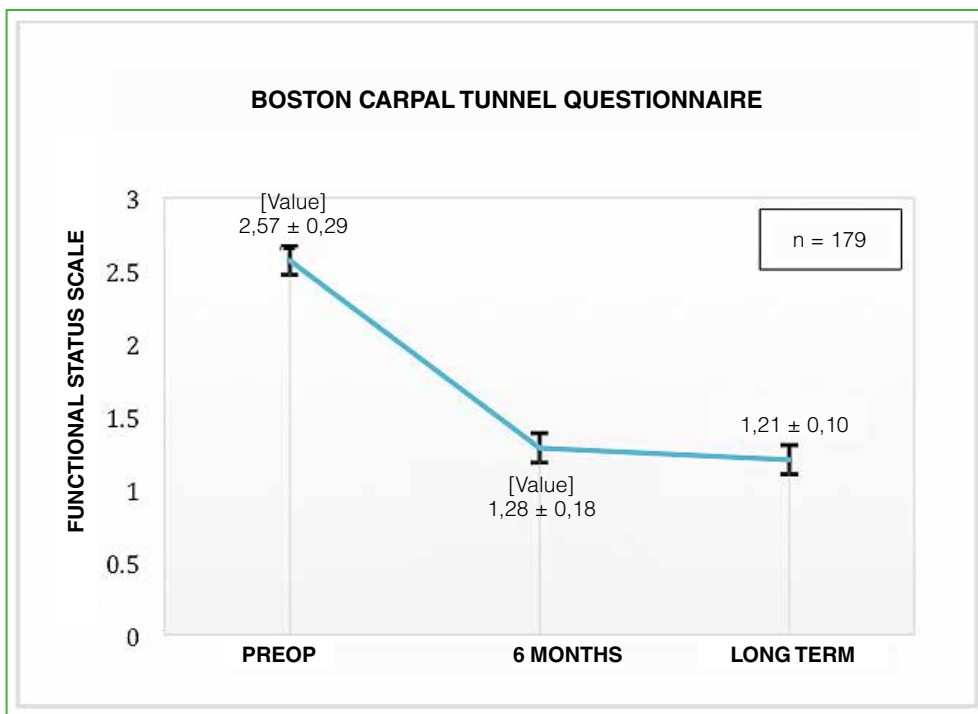
## RESULTS

The average follow-up period was 97.9 months (range, 42-162). Patients reported an average CTS symptomatic period of 9.8 months (range, 6-18). The symptom severity and functional evaluations were performed using BCTQ-SSS and BCTQ-FSS 6 in the preoperative period, at the 6-month postoperative follow-up and at the last long-term follow-up.

The average BCTQ-SSS was  $3.20 \pm 0.26$  in the preoperative period, which improved to  $1.30 \pm 0.12$  with a significant difference at 6-month postoperative follow-up and remained without a significant difference at  $1.25 \pm 0.11$  in the long-term (Figure 4). The average BCTQ-FSS was  $2.57 \pm 0.29$  in the preoperative period, which improved to  $1.28 \pm 0.12$  with a significant difference at 6-month postoperative follow-up and remained without a significant difference at  $1.20 \pm 0.01$  in the long-term (Figure 5).



**Figure 4.** Chart showing the average BCTQ-SSS scores.



**Figure 5.** Chart showing the average BCTQ-FSS scores.

At last follow-up, 96% of patients were satisfied with the endoscopic outcome.

The available data included 7 complications associated with transient postoperative neurapraxia (3.2%). Three cases developed neurapraxia of the common digital nerve of the third web space, 2 developed ulnar nerve neurapraxia, and 2 developed median nerve neurapraxia. All complications occurred in patients who underwent surgery during the first two years of the considered ten-year period. All patients demonstrated a normal neurologic status at the 6-month follow-up control. There were no major neurovascular complications, and no patient required to be converted to open technique.

## DISCUSSION

Thirty years after the first publications on endoscopic TCL release in CTS patients, these procedures have been found to be effective and safe, with success rates beyond 95% according to Levine's BCTQ scales or other similar scales, and no significant differences between these procedures and OCTR procedures outcomes in the long-term.<sup>11-16</sup> However, it is important to highlight that OCTR remains a reliable procedure based on the advantage of its technical simplicity, although it also continues to be associated with potential residual pain, both at the surgical wound or at the thenar or hypothenar eminence.<sup>5,6</sup>

TCL OCTR disadvantages in the surgical treatment of CTS patients prompted the independent and concurrent works of Okutsu and Chow, who designed and developed two different techniques to achieve endoscopic carpal tunnel release, which have the common feature the infraretinacular ligament dissection.<sup>7,8</sup> Okutsu and Chow techniques paved the way for the current single-portal and dual-portal endoscopic techniques, which share a more complex technical challenge, but also satisfactory clinical outcomes once the surgical teams master a high technical level.<sup>11-16</sup>

The endoscopic carpal tunnel release has been adopted as the technique of choice by several surgical teams, aiming to procure the features of the minimally invasive surgical procedures associated with good outcomes. However, the shared benefits posed by single-portal and dual-portal endoscopic procedures may be severely tarnished by serious neurovascular complications.<sup>21-24</sup>

Chow dual-portal technique for the TCL endoscopic release is a reliable option in CTS surgical management. The adequate local anesthetic administration, accurate localization of portals, intimate knowledge of the endoscopic anatomical features of the wrist, clear visualization of the carpal tunnel structures, and endoscopic surgical dexterity allow for optimal outcomes. The administration of local anesthesia enables surgeon-patient communication during the procedure, which may reduce potential intraoperative risks.<sup>17</sup>

This historical cohort study on Chow dual-portal procedures within a ten-year period has produced results that compare favorably with similar studies results. A noteworthy characteristic of this study is that there was a limited number of verified complications and a 96% satisfaction rate at last follow-up. It should be noted that the complications occurred in patients who underwent surgery during the first two years of the study period, all 7 of which were cases of transient postoperative neurapraxia that recovered at the 6-month follow-up control.

It is important to highlight that the current single- and dual-portal endoscopic release techniques are both infraretinacular surgical procedures and have similar long-term clinical outcomes. Therefore, choosing between one or the other has more to do with the surgical team's practical knowledge of the procedure intricacies and instrumentation preferences rather than the procedure advantages and potential disadvantages.<sup>7-16,25-29</sup>

The disadvantage shared by both single- and dual-portal endoscopic techniques is the insertion of instrumentation through a carpal tunnel which structures are compressed, resulting in a procedure associated with a risk for temporary or permanent median nerve injury. Consequently, some studies and clinical experiences have suggested the use of suprarretinacular endoscopic carpal tunnel release techniques, which share performing the TCL dissection without instrumentation into the carpal tunnel. However, these endoscopic procedures may result in potential neurologic injuries in patients with anatomical variations, as well as damage to the palmar mechanoreceptors of the wrist, and so do not seem to pose a superior alternative to the current infraretinacular techniques.<sup>30-32</sup>

## CONCLUSIONS

The endoscopic carpal tunnel release with Chow dual-portal technique is a standard, effective and safe surgical method for the treatment of idiopathic CTS. The rate of postoperative complications is minimized when the surgical procedure is performed by a well-oiled surgical team led by an experienced surgeon.

Conflict of interests: The authors claim they do not have any conflict of interest.

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