Hand Surgery and Rehabilitation 36 (2017) 198–201

Available online at
ScienceDirect
www.sciencedirect.com

Elsevier Masson France
EM|consulte
www.em-consulte.com

Original article

Trans-metacarpophalangeal traction to avoid finger-related complications during wrist arthroscopy: Feasibility study with 20 cadaver wrists

Traction trans-métacarpo-phalangienne pour éviter les complications digitales en arthroscopie du poignet : étude de faisabilité à propos de 20 poignets de cadavres

J.J. Hidalgo Diaz [a], G. Asmar [a], L. Buendia [b,c], S. Hendriks [a], S. Facca [a], P. Liverneaux [a,*]

[a] *Department of Hand Surgery, SOS main, CCOM, University Hospital of Strasbourg, FMTS, University of Strasbourg, Icube CNRS 7357, 10, avenue Baumann, 67400 Illkirch, France*
[b] *Department of Hand Surgery, Hospital Samaritano, R. Conselheiro Brotero, 1486, Higienópolis, São Paulo SP 01232-010, Brazil*
[c] *Department of Hand Surgery, Hospital Carmino Carricho, Avenue Celso Garcia, 4815 Tatuapé, São Paulo SP 03063-000, Brazil*

ARTICLE INFO

Article history:
Received 15 July 2016
Received in revised form 10 December 2016
Accepted 9 January 2017
Available online 30 March 2017

Keywords:
Arthroscopy
Distraction
Chinese finger traps
Wrist
Traction

ABSTRACT

Some of the iatrogenic complications of wrist arthroscopy are related to the traction applied to the fingers. The aim of this work was to test whether trans-metacarpophalangeal (trans-MCP) traction would provide sufficient distraction of the radiocarpal and midcarpal joint spaces to perform wrist arthroscopy without exerting any mechanical stress on the fingers, from the metacarpophalangeal (MCP) joints to the distal phalanges. Our study included 20 cadaveric wrists mounted on an arthroscopic traction tower maintained by finger traps placed on the 2nd and 4th fingers. For each wrist, three fluoroscopic views were taken: without traction, with finger traction (78.45 N), with trans-MCP traction (78.45 N). The average height of the midcarpal joint space was 0.8305 cm without traction, 1.037 cm with finger traction, and 1.1 cm with trans-MCP traction. The height of the radiocarpal joint space averaged 0.853 cm without traction, 1.167 cm with finger traction, and 1.187 cm with trans-MCP traction. There were no differences between the heights of joint spaces between digital and trans-MCP traction. Our results show that trans-MCP traction provides distraction of the wrist joint spaces equivalent to that obtained with finger traction. However, we still need to develop a trans-MCP traction device usable in clinical practice.

Mots clés :
Arthroscopie
Distraction
Doigtiers chinois
Poignet
Traction

RÉSUMÉ

Certaines complications iatrogènes de l'arthroscopie du poignet sont liées à la traction exercée sur les chaînes digitales. L'objectif de ce travail était de vérifier si une traction trans-métacarpienne permettait d'obtenir une distraction au moins égale à la traction digitale, sans exercer de contrainte mécanique sur les chaînes digitales. Notre série comprenait 20 poignets cadavériques installés sur tour de traction avec des doigtiers chinois sur les deuxième et quatrième doigts. Pour chaque poignet, trois clichés radioscopiques de face étaient réalisés : sans traction, avec traction digitale (78,45 N), avec traction trans-métacarpienne (78,45 N). La hauteur de l'interligne médiocarpien était en moyenne de 0,8305 cm sans traction, 1,037 cm avec traction digitale, 1,1 cm avec traction trans-métacarpienne. La hauteur de l'interligne radiocarpien était en moyenne de 0,853 cm sans traction, 1,167 cm avec traction digitale, 1,187 cm avec traction trans-métacarpienne. Il n'y avait pas de différence entre les hauteurs d'interlignes entre traction digitale et trans-métacarpienne. Nos résultats montrent qu'une traction trans-métacarpienne permet d'obtenir une distraction des interlignes du poignet équivalente à celle obtenue avec une traction digitale. Reste à mettre au point un dispositif de traction trans-métacarpienne utilisable en pratique clinique.

* Corresponding author at: Hand Surgery Department, Strasbourg University Hospitals, 10, avenue Baumann, 67403 Illkirch, France.
E-mail address: Philippe.liverneaux@chru-strasbourg.fr (P. Liverneaux).

http://dx.doi.org/10.1016/j.hansur.2017.01.006
2468-1229/

1. Introduction

Since the first wrist arthroscopy was performed in 1979 [1], it has become an essential technique in wrist surgery [2]. It has emerged as a first-line diagnostic and therapeutic tool, extending to more indications at the expense of open surgery [3].

This increased use of wrist arthroscopy has been accompanied by an increase in iatrogenic complications, some of which are directly related to the tension placed on the fingers: skin lesions, stretched ligaments, vascular and neurological disorders [4,5].

The aim of this work was to test whether trans-metacarpophalangeal (trans-MCP) traction will provide sufficient distraction of the radiocarpal and midcarpal joint spaces to perform wrist arthroscopy under satisfactory conditions, while avoiding the exertion of any mechanical stress on the fingers, from the metacarpophalangeal (MCP) joints to the distal phalanges.

2. Materials and methods

Our study included 20 cadaveric wrists (8 right and 12 left). These 20 wrists were mounted upright on a wrist arthroscopy traction tower with an eccentric column, maintained by Chinese finger traps placed on the 2nd and 4th fingers. The traction force was controlled by a mechanical dynamometer hook (FA20 Model®, Jump™, Basel, Switzerland). A fluoroscopic machine (XISCAN Mini C-arm®, FM CONTROL™, Barcelona, Spain) was set up horizontally to take pictures from the front showing the radiocarpal, midcarpal and MCP joints of the fingers (Fig. 1). Radiographic magnification was 105%.

For each wrist, images were taken from the front: one without traction, one with finger traction and one with trans-metacarpal traction. On the first view, no extra weight was applied to the wrist. For the second view, continuous traction of 78.45 Newton (8 kg mass) was applied on the proximal phalanges by means of the Chinese finger traps. For the third view, continuous traction of 78.45 Newton (8 kg mass) was applied to the metacarpals by the means of a 2 mm trans-metacarpal Kirschner wire.

The results were evaluated with Photoshop CS5® (Adobe™) and consisted in measuring the height of the midcarpal and radiocarpal joint spaces on all three fluoroscopic views for all 20 wrists (Fig. 2).

Statistical analysis compared the average of quantitative paired variables. Given the size of our study, Student's *t*-test and Bonferroni correction were used to compare groups. The assumptions of normality of distributions and homogeneity of variances were verified allowing us to compare these groups. In the tests comparing mean values for the midcarpal and radiocarpal joint space heights, the "*P*" value was considered significant if $< 5\%$ to control the Type I risk.

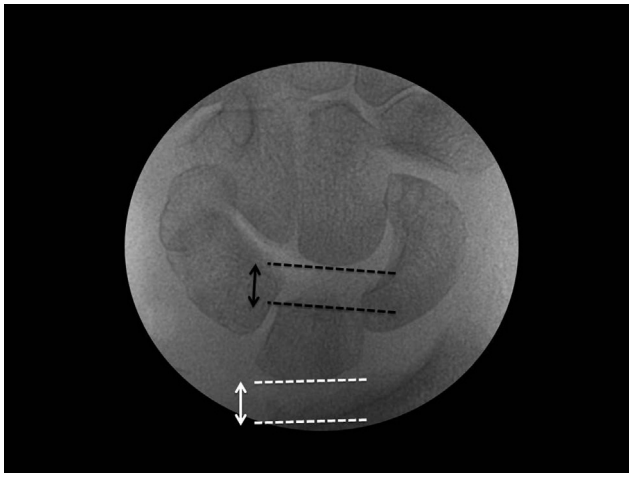

Fig. 2. Measuring the midcarpal and radiocarpal joint space heights from the summit of the tangents of the four Gilula's lines. The height of the midcarpal joint corresponded to the line segment extending perpendicularly to the tangent to the head of the capitate to the distal articular surface of the lunate (black arrow). The height of the radiocarpal joint corresponded to the line segment extending perpendicular to the tangent to the proximal articular surface of the lunate to the articular surface of the radius (white arrow).

Fig. 1. Installation. The wrist is upright on a traction power (white star). The traction force is controlled by a dynamometer (black star). A fluoroscope is installed horizontally.