



ELSEVIER

Available online at www.sciencedirect.com

ScienceDirect

British Journal of Oral and Maxillofacial Surgery xxx (2019) xxx–xxx

BRITISH
Journal of
Oral and
Maxillofacial
Surgerywww.bjoms.com

Short communication

Technique for achieving a stable position of the condylar process during injection into the temporomandibular joint

Z. Barath^{a,*}, Z. Rasko^b^a Department of Prosthodontics and Dental Radiology, Faculty of Dentistry, University of Szeged, Szeged, Hungary^b Oral and Maxillofacial Surgery, University Hospital Limerick, Dooradoyle, Limerick, Ireland

Abstract

Our purpose was to develop a reproducible and easy-to-use technique to establish the best place to inject the temporomandibular joint (TMJ) that ensured stable positioning of the condylar process. We implemented a 3-dimensional process to treat osteoarthritis of the TMJ with hyaluronic acid that was guided by cone-beam computed tomography (CT), and stabilised with a maxillomandibular wax bite block. Two wax rims (fabricated from previously-taken impressions) were attached together securely to stabilise the condyles during imaging and to fix the maxillomandibular position. The use of 3-dimensional cone-beam CT increased the accuracy of the injection. The point, angle, and depth were ascertained precisely, which was intended to ensure safety and give the physician confidence, even when treating patients with anatomical anomalies. The procedure had good stability (the displacing effect of muscle contraction was eliminated) and it presented an easy and reproducible 3-dimensional method for injecting the TMJ that was safer than the conventional one.

© 2019 Published by Elsevier Ltd on behalf of The British Association of Oral and Maxillofacial Surgeons.

Keywords: CBCT; temporomandibular joint; TMJ; TMJ pain management; TMJ injection point; Guarda-Nardini injection point; temporo-mandibular disorders; hyaluronic acid

The management of pain in the temporomandibular joint (TMJ) is one of the most difficult and controversial treatments for physicians.^{1,2} The instillation of hyaluronic acid has been shown to be effective in the management of osteoarthritis of the TMJ. Guarda-Nardini et al suggested that a single-needle technique should be used for both the injection and the aspiration of fluid from the posterior recess of the upper joint space.^{3–6} Ascertaining the correct site for the injection is essential to the effectiveness of the treatment. This point cannot be established accurately in cases of internal derangement, anatomical deviations, developmental anomalies, and post-traumatic conditions. They also suggested using CT imaging to gather information about potential joint degeneration to ensure accuracy.⁷

The purpose of this study was to develop a reproducible and easy-to-use technique to establish the best location to inject the TMJ using the single-needle technique with a stable condylar process and the superior recess of the TMJ in the most appropriate position. A retrospective, dual-centre study was carried out to evaluate radiographic data from 12 patients.

We took anatomical impressions of each patient's upper and lower dentitions, then inserted wax bite blocks in a position about 4 mm short of maximal opening. Before scanning, we marked the Guarda-Nardini line and injection point on the face. We then placed a sphere of gutta-percha that had been softened with chloroform on the marked injection point using a dental plugger. If the point of injection was not seen easily on cone-beam CT, we applied an additional amount of gutta-percha to the Guarda-Nardini point, and took the scan again. Using axial and multi-planar reformation views of the cone-beam CT images, and considering surrounding anatomical structures, we established the exact position, depth, and

* Corresponding author.

E-mail address: barzol34@gmail.com (Z. Barath).<https://doi.org/10.1016/j.bjoms.2019.09.004>

0266-4356/© 2019 Published by Elsevier Ltd on behalf of The British Association of Oral and Maxillofacial Surgeons.



Fig. 1. Lateral view of the patient with the wax rim in situ, the condyles in a stable position, and the jaw secured in a submaximal open position. Insertion of the needle under sterile circumstances; mouth opening to about 4 mm short of the maximum opening position places the condyles in an antero-caudal position.

angle of the injection with a high degree of accuracy. We then marked the Guarda-Nardini point with a sterile skin marker.

We inserted the needle at the specified point with the wax block in situ (Fig. 1). Deviation of our defined insertion point from the marked point did not change the depth of insertion substantially (Fig. 2). The angle of insertion of the needle was ascertained by using a line drawn from the Guarda-Nardini point perpendicular to the skin, which was parallel to the horizontal/axial plane. The average was 30°–35° degrees caudally. The horizontal angle coincided with the “perpendicular” line (Figs. 2 and 3).

Table 1 shows the measured deviation of our defined insertion point from the marked point. In all 12 patients there

was deviation either horizontally (average 1.1 mm) or vertically (average 1.3 mm), particularly in those with anatomical anomalies. In one of the 12, the 3-dimensional image showed that the Guarda-Nardini point we had marked was in fact located too inferiorly, and so the hyaluronic acid would have been placed at the wrong site. Imaging showed that the mesio-distal direction was correct, and so we moved the injection point 4 mm vertically.

The treatment of disorders of the TMJ has always been a challenge, and the techniques^{8,9} and drugs^{1,2} used to address such symptoms remain controversial. The injection of hyaluronic acid into the upper joint space can provide remarkable improvement of symptoms and end long-term pain.^{3–6,10}

This technique is a safe, reproducible, and easy-to-use to establish the best point of injection in the TMJ. It has several advantages over the standard technique using a fixed injection point because: there is minimal trauma to the joint because the risk of intra-articular injury is reduced considerably; preoperative planning helps to ensure that any anatomical abnormalities that could cause problems are identified; the risk of the injection being placed extra-articularly is reduced appreciably, and the success rate is therefore improved; there is minimal postoperative discomfort because the additional volume of fluid dissolves from the intra-articular space in a short time and finally; additional local anaesthesia is not required as only a single insertion is necessary.

We recommend this technique as it is safe, easy, and avoids the placement of injected materials in the wrong location. In addition to its other advantages, it is reproducible, and all images and data can be stored, re-evaluated, and compared with later stages of treatment, which will allow easier follow

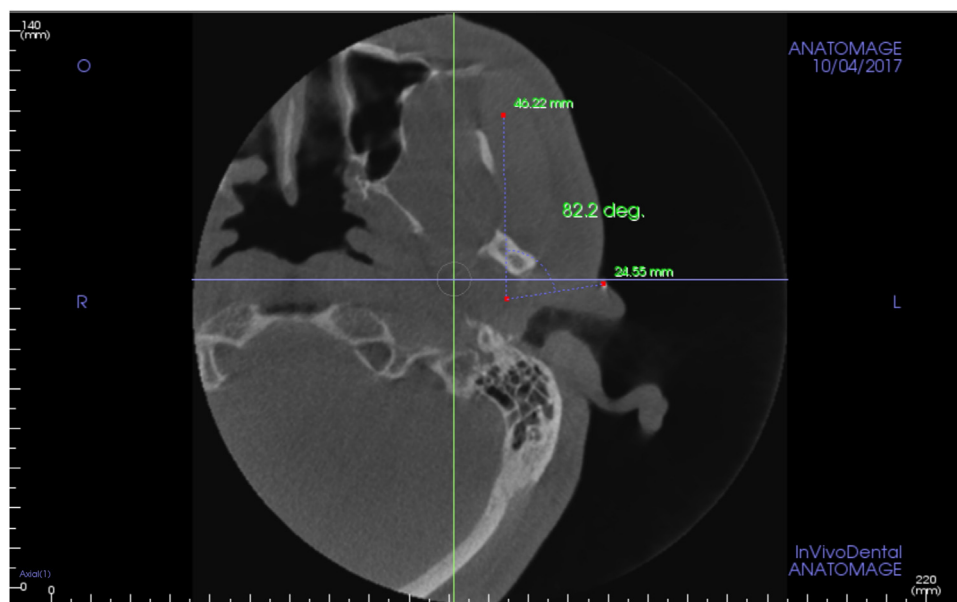


Fig. 2. Axial plane of cone-beam computed tomogram showing the distance from the insertion point on the skin to the ideal depth of injection in the upper joint space. The horizontal angle coincided with the perpendicular line drawn on the skin.

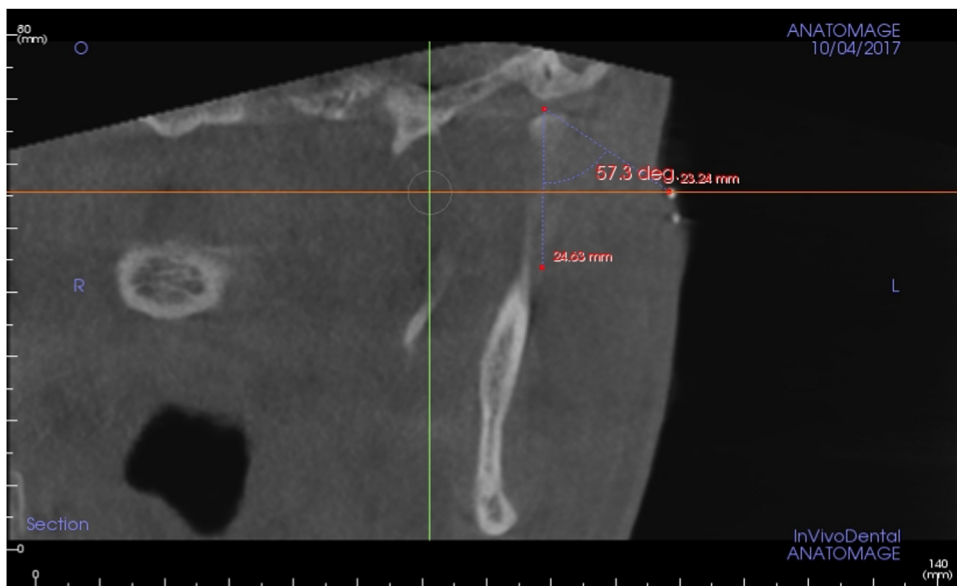


Fig. 3. Coronal cone-beam computed tomogram showing the Guarda-Nardini insertion point and the measured correct insertion point cranial to it. The angle of insertion of the needle is 32.7° (calculated as 57.3° measured on the coronal plane - the vertical line is deducted from 90°), which would be the perpendicular line to the skin. The usual angle of insertion measured was between 30° and 35°.

Table 1

The deviation of injection point from original Guarda-Nardini-point in both vertical and horizontal aspect in 12 patients sorted by age and sex. The vertical deviation is significant considering this can cause relatively higher risk of injection targeting failure into the upper segment of the temporomandibular joint.

Case No.	Sex	Age (years)	Vertical deviation of injection (mm)	Horizontal deviation of injection (mm)
1	Male	58	4	0
2	Male	62	2	1
3	Female	53	1	1
4	Female	56	1	2
5	Female	45	1	1
6	Female	43	0	1
7	Male	65	1	1
8	Female	57	1	0
9	Male	59	1	2
10	Female	63	1	1
11	Female	47	1	1
12	Male	59	2	2
Mean (SD) deviation in mm (%)			1.3 (98)	1.1 (67)
Mean (SD) deviation for women in mm (%)			0.9 (38)	1.0 (58)
Mean (SD) deviation for men in mm (%)			2.0 (122)	1.2 (84)

up of the affected TMJ, and cone-beam CT does not require a large radiation load.

Conflict of interest

We have no conflicts of interest.

Ethics statement/confirmation of patients’ permission

We have ethics approval and the patients’ permission.

References

1. Kopp S, Carlsson GE, Haraldson T, et al. Long-term effect of intra-articular injections of sodium hyaluronate and corticosteroid on temporomandibular joint arthritis. *J Oral Maxillofac Surg* 1987;45:929–35.
2. Kopp S, Wenneberg B, Haraldson T, et al. The short-term effect of intra-articular injections of sodium hyaluronate and corticosteroid on temporomandibular joint pain and dysfunction. *J Oral Maxillofac Surg* 1985;43:429–35.
3. Basterzi Y, Sari A, Demirkan F, et al. Intraarticular hyaluronic acid injection for the treatment of reducing and nonreducing disc displacement of the temporomandibular joint. *Ann Plast Surg* 2009;62: 265–7.

4. Guarda-Nardini L, Ferronato G, Favero L, et al. Predictive factors of hyaluronic acid injections short-term effectiveness for TMJ degenerative joint disease. *J Oral Rehabil* 2011;**38**:315–20.
5. Machado E, Bonotto D, Cunali PA. Intra-articular injections with corticosteroids and sodium hyaluronate for treating temporomandibular joint disorders: a systematic review. *Dental Press J Orthod* 2013;**18**: 128–33.
6. Manfredini D, Piccotti F, Guarda-Nardini L. Hyaluronic acid in the treatment of TMJ disorders: a systematic review of the literature. *Cranio* 2010;**28**:166–76.
7. Guarda-Nardini L, Cadorin C, Frizziero A, et al. Interrelationship between temporomandibular joint osteoarthritis (OA) and cervical spine pain: effects of intra-articular injection with hyaluronic acid. *Cranio* 2017;**35**:276–82.
8. Long X, Chen G, Cheng AH, et al. A randomized controlled trial of superior and inferior temporomandibular joint space injection with hyaluronic acid in treatment of anterior disc displacement without reduction. *J Oral Maxillofac Surg* 2009;**67**:357–61.
9. Torres DE, McCain JP. Arthroscopic electrothermal capsulorrhaphy for the treatment of recurrent temporomandibular joint dislocation. *Int J Oral and Maxillofac Surg* 2012;**41**:681–9.
10. Cascone P, Fonzi Dagger L, Aboh IV. Hyaluronic acid's biomechanical stabilization function in the temporomandibular joint. *J Craniofac Surg* 2002;**13**:751–4.