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Tomographic Evaluation After Mandible Orthognathic Surgery: Lingual Short Split Technique

Evaluación Tomográfica Después de la Cirugía Ortognática Mandibular: Técnica de División Lingual Corta

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PIMENTA E SOUZA, D.; SHINOHARA, E.; BUYSSE TEMPRANO, A. V.; SANT'ANA, E. Tomographic evaluation after mandible orthognathic surgery: Lingual short split technique. *Int. J. Odontostomatol. 18(3)*:360-366, 2024.

ABSTRACT: Mandibular sagittal osteotomy is a routine technique in orthognathic surgery; some modifications have been performed over time. The lingual short split mandibular osteotomy technique show a modification in the lingual design being shorter and below the lingula, and is described with fewer complications. For years, radiographs were the only way to evaluate the design of osteotomies and the lingual trace could not be evaluated. Computerized Tomography (TC) allowed the evaluation of the designs of the surgical fractures, making it possible to assess the postoperative result. Was realized prospective research using 60 CT scans of patients operated on using the lingual short split technique, including variables related to the technique in the lingual cut. As a result, 73.33 % were type 1, 18.33 % type 2, 6.66 % type 3, and 1.66 % type 4. Types 1 and 2 have a fracture line drawing similar to the original technique; type 3 has a small variation; type 4 presented bone fragmentation. We conclude that the technique is predictable, without significant statistical variables, and well-visualized tracing with the methodology used. A new classification of the technique was recommended and is necessary to correlate it with clinical results in future studies.

KEY WORDS: orthognathic surgery, mandibular osteotomies, short lingual split, sagittal ramus osteotomy.

INTRODUCTION

Bilateral sagittal mandibular ramus osteotomy is a technique used in orthognathic surgery as a routine. This technique may show some problems, such as the possibility of bad fractures, the presence of bone interference when repositioning after the desired movement, areas with bone fragility related to mandibular anatomy and surgical design, and the difficulty of performing exclusively intraorally handling of the inferior alveolar nerve and its adequate intraosseous repositioning with the chance of post-osteosynthesis bone instabilities (Bell & Schendel, 1977; Epker, 1977; Arnet, 1993; Böckmann, 2017; Sant'Ana *et al*., 2017; Susarla *et al*., 2020). Sant'Ana *et al*. (2017), described the short lingual fracture technique or short lingual fracture. In this technique, the lingual osteotomy is performed with a micro saw below the lingula, from the retromolar triangle to the middle of the ramus, parallel to the mandibular plane, without reaching the posterior region. The line then extends anteriorly, over the oblique line, tangential to the mandible to the region between the first and second molars, deepening the saw without reaching the lower alveolar vascular nerve bundle. Upon reaching the region between the first and second molars, the saw is moved vertically, up to the basal, as shown (Fig. 1). The alveolar nerve is adhered to the proximal stump, with minimal manipulation, and with a lower risk of undue fractures ascending to the ramus or bone fragments that could cause nerve damage. It does not require the placement of instruments horizontally in the mandibular ramus, leading to greater technical ease and consequent lower possibility of complications such as undue fractures and paresthesia (Sant'Ana *et al*., 2017).

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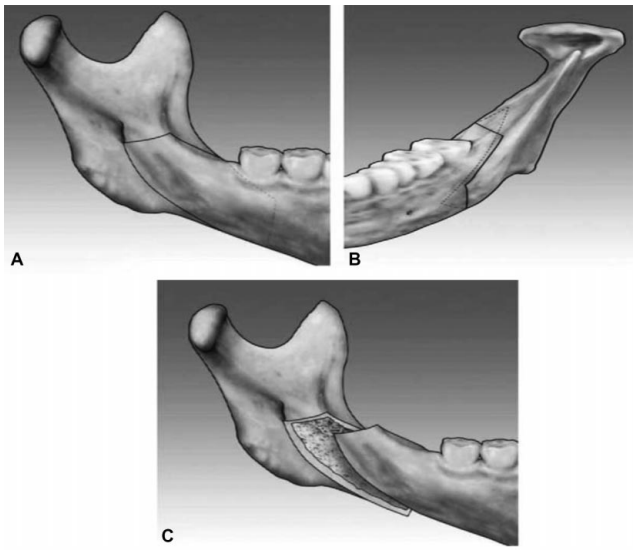

Fig. 1. Short lingual split by Sant'Ana *et al*. (2017). A and B: Osteotomy design. C: Osteotomy performed.

There are no studies that confirm the lingual fracture line below the lingula and with a descending path, nor if there is a greater frequency and direction in its design, areas of fragility, the pattern of displacement of the stumps, and frequency. Computerized tomography (CT) scans are used for planning and postoperative evaluation of patients undergoing orthognathic surgery, with the possibility of measuring bone anatomy, airways, TMJ changes and postoperative behavior, fracture design including lingual, osteosynthesis, and stability for variable periods.

This research carries out a prospective study of the lingual short split technique through postoperative computerized tomography, verifying the lingual fracture traces, its path, and incidence, and if it is a predictable technique when compared to conventional techniques.

MATERIAL AND METHOD

Thirty-cone beam computerized tomography (CBCT) scans were prospectively examined, obtained on average 15 days after mandibular orthognathic surgery exclusively using the lingual short split mandibular sagittal osteotomy technique.

The patients were included in surgical treatment according to the principle of surgical requirements and opportunity, under general anesthesia and 2 surgeons, in São Paulo (SP) and Bauru (SP). The age range of the patients was 18 to 50 years., were treated using the lingual short split technique, regardless of the mandibular movement (advance, retreat, rotation of the occlusal plane) and whether it was associated with maxillary surgery; the osteosynthesis performed with a 2.0 system, straight sagittal jaw plates, and 2.0 screws.

The exclusion criteria were:1) Patients who suffered accidents or pre-surgical fractures that could interfere with the mandibular anatomy, 2) presence of impacted third molars, 3) Subjects who did not comply with the established protocol for the acquisition of TC 4) Outside the age group of 19-50 years, 5) Neurological or psychiatric disorders, 6) Metabolic bone alterations or use of bisphosphonates and other osteomodulatory drugs, 7) Chronic use of corticosteroids, 8) Syndromes that cause mandibular anatomical alterations, 9) Jaw surgery orthognathic previous, 10) Patients with comprehension and/or cooperation difficulties, 11) Cases where there were previous regional infections and/or necrosis of bone, 12) With a history of previous mandibular regional bone pathology, 13) Submitted to previous grafts in the area of surgery.

CBCT scans of the mandible were requested in specialized radiological clinics, on average 15 days after surgery with patients still using removable intercuspal elastics, according to a protocol already established and published by Muto *et al*. (2012). ICAT device was used, at 0.3 voxels, 170.00mm fov, 120kVp voltage, 5mA, sent in DICOM standard, opened, and handled for viewing using DOLPHIN IMAGING PLUS software version 11.95. The images were handled and sectioned in sagittal sections, obtaining the right and left images of the mandible, in three-dimensional reconstructions evaluating the pattern and design of the osteotomy exclusively by lingual, the path and bone separation, height in relation to the lingula, and the results.

The images were verified by the examiner, experienced in handling the software with postoperative tomographic images of mandibular orthognathic surgery, performing the classification of the drawing patterns of the lingual fracture tracings obtained. The position of the lingula, the position of the fracture in the mandibular ramus, the anterior, posterior, and inferior bone edges, and the uniformity of its path were used as references.

The risks of this research were minimal since it was a prospective and observational tomographic study of patients already operated on. CBCT devices have low and controlled radiation emissions compared to radiography or multislice CT.

There was no conflict of interest in this paper, and it was carried out respecting the ethical and biological limits of each patient.

The work was approved by the FOB ETHICS AND RESEARCH COMMITTEE and Brazil platform under number CAAE 16221319.1.0000.5417 starting on 10.09.2019 (Annex A).

RESULTS

The sample was obtained from October 2019 to March 2021, consisting of 30 patients, 13 females and 17 males 18 to 46 years old, with a mean of 26.9 years, complying with the criteria of inclusion. In total, there were 60 osteotomies, right and left, with the distribution and casuistry shown in Tables I and II. No patient was excluded from the sample due to non-compliance with the inclusion or exclusion protocol.

Table I. General sample characteristics.

Participant	Age	Sex	Lingual Fracture Classification	
			Right side	Left side
1	25	F	3	2
2	31	F	3	2
3	38	F	2	1
4	29	M	1	1
5	30	F	1	1
6	33	F	1	1
7	27	M	1	1
8	23	F	1	1
9	32	M	1	4
10	24	M	1	1
11	18	M	2	1
12	32	M	1	1
13.	36	M	1	1
14	46	F	1	1
15	29	M	1	1
16	20	F	1	1
17	24	M	2	1
18	25	F	1	2
19	22	F	1	1
20	24	M	1	1
21	26	M	2	2
22	21	M	3	2
23	22	F	1	1
24	18	F	1	1
25	20	M	1	2
26	28	M	1	1
27	35	M	1	1
28	24	M	1	1
29	22	F	1	1
30	23	M	2	3

All 60 osteotomies evaluated followed the standardization of the surgical technique described for the sagittal mandibular lingual short split osteotomy, according to the description by Sant'Ana *et al*. (2017). Four patterns of fracture of the lingual table were observed, and classification was assigned to them: Type 1 when the tracing was similar to the technical description by Sant'Ana *et al*. (2017); type 2 with medial horizontal line equal to type 1, but descending lingual line was straight or slightly posterior to the position of the lingula, towards the mandibular base, not semilunar; type 3 with an anterior medial horizontal cut similar to types 1 and 2, but without downward lingual fracture, but to posterior, reaching the posterior region of the ramus, without fragmentation and descending to anterior from this point and type 4, with a similar design to type 2, but with the fragmentation of the end of the path close to the base.

The type 3 classification design was similar to the Dal Pont design (1961), but with the medial cut below the level of the lingula. As for the percentage of distribution, we had 73.33 % of the sample or 44 osteotomies of type 1, 18.33 % or 11 osteotomies of type 2, 6.66 % or 4 osteotomies classified as type 3, and 1.66 % or 01 osteotomies of type 4.

The tomographic images obtained in sagittal, right, and left sections, according to the classification above, can be seen in Figures 2 and 3.

Regarding sex, it was obtained a sample of 17 men and 13 women, being 24 osteotomies in men (70.58% of the total) and 20 in women (76.92 %) corresponding to type 1 classification; there were 7 men (20, 58 %) and 4 women (15.38 %) type 2; 2 men (5.88 %) and 2 women (7.69 %) type 3; and only one type 4 male mandible osteotomy (2.94 %).

Regarding the side, 22 right and 22 left osteotomies were type 1 (73.33 % of the sample for each side and 73.33% of the total); 5 right (16.66 %), and 6 left (20 %) type 2 (18.33 % of the total); 3 right (10 %) and 1 left (3.33 %) type 3 (6.66 % of the total); and 1 on the left side (3.33 % of the total for the left side or 1.66 % of the total) type 4.

Table II. Numerical and percentage distribution of the design of lingual fractures.

Absolute Total	Type 1	Type 2	Type 3	Type 4	Total
	44	11	4	1	60
Total Percentage by Trace Type	73,33 %	18,33 %	6,66 %	1,66 %	100 %

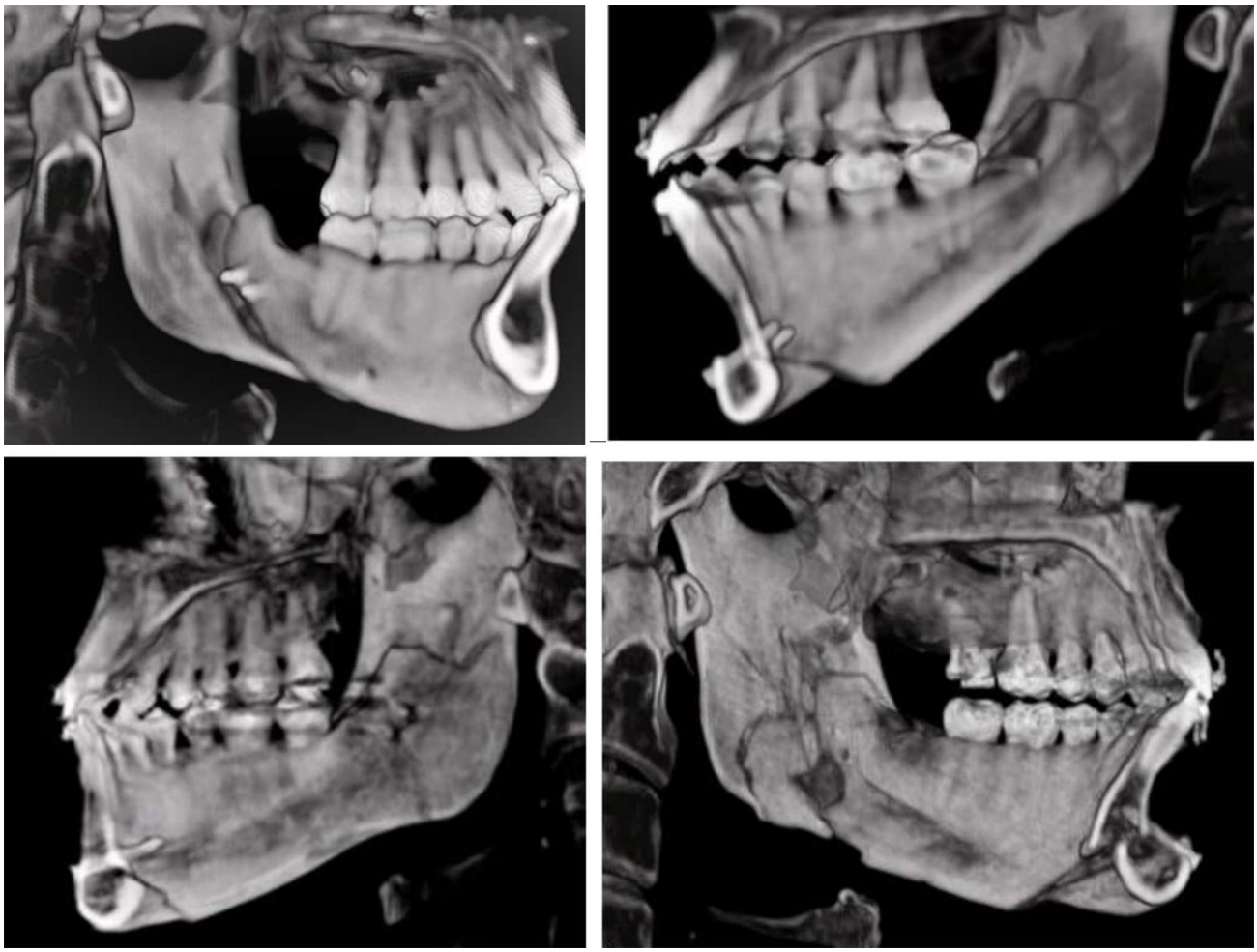

Fig. 2. Tomographic image of lingual tracing (top left type 1, top right type 2, bottom left type 3 and bottom right type 4).

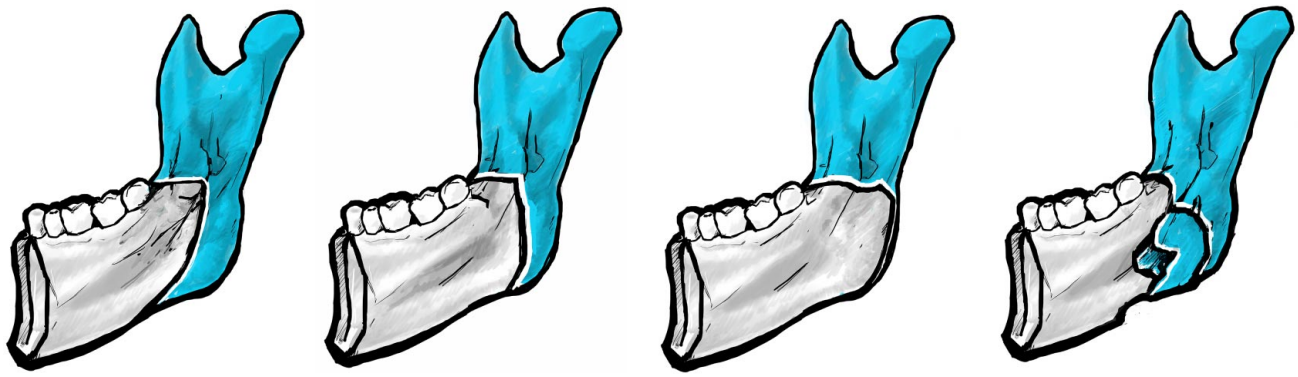

Fig 3. Design of the fractures obtained in the study, following types 1,2,3 and 4.

For statistical calculation, the study used the chi-square test for the sample, with a p of 0.554 for laterality, a p of 0.464 for age, and a p of 0.769 for sex. There were no statistically significant differences in the studied sample (significant sample if p less than 0.05) relative to age, sex, and laterality parameters (Table III).

Table III. Sample statistics in the parameters evaluated.

Statistical Analysis by Age							
Range		1	2	3	4	Total	p
Until 25y	n	22	7	3	0	32	
	%	68,8	21,9	9,4	0,0	100,0	
> 25y	n	22	4	1	1	28	0,464
	%	78,6	14,3	3,6	3,6	100,0	
Statistical Analysis by Sex							
Sex		1	2	3	4	Total	p
Feminine	n	20	4	2	0	26	
	%	76,9	15,4	7,7	0,0	100,0	0,769
Masculine	n	24	7	2	1	34	
	%	70,6	20,6	5,9	2,9	100,0	
Statistical Analysis by Side							
Side		1	2	3	4	Total	p
Right	n	22	5	3	0	30	
	%	73,3	16,7	10,0		100,0	0,554
Left	n	22	6	1	1	30	
	%	73,3	20,0	3,3	3,3	100,0	

DISCUSSION

The bilateral mandibular sagittal osteotomy technique provides adequate bone contact and good results, but it still has some drawbacks, especially related to paresthesia in the inferior alveolar and sometimes lingual nerves, to fractures that are sometimes improper and ascending to the mandibular condyle and TMJ (Hunsuck, 1968; Bell & Schendel, 1977; Epker, 1977;Arnett, 1993; Puricelli, 2010; Pereira *et al*., 2010; Oth *et al*., 2012; Aarabi *et al*., 2014; Böckmann *et al*., 2015; Dreiseidler *et al*., 2016; Sant'Ana *et al*., 2017).

From a technical point of view, obtaining the sagittal and vertical fracture line from the buccal side of the mandible is relatively easy to perform, since its visualization is well observed. The lingual fracture line, after cutting with a saw, drill, or ultrasonic tip, although it can be visualized in its medial design above the lingula if with adequate anatomical distance, has a limitation regarding the complement of the fracture. Thus, despite being delimited and drawn with a drill horizontally, when proceeding with the mandibular surgical fracture itself, it is not possible to perfectly visualize how this trace occurs on the lingual table of the ramus and mandibular body, due to the presence of anatomical structures (Kriwalsky *et al*., 2008; Plooij *et al*., 2009; Lloyd *et al*., 2011; Beukes *et al*., 2013; Muto *et al*., 2012; Aarabi *et al*., 2014; Sant'Ana *et al*., 2017; Cunha, 2018;2020; Ferri *et al*., 2019; Hu *et al*., 2019).

It is not known for sure how these variables of tracings or lingual intercurrences can interfere with the results of sagittal mandibular orthognathic surgery. For years, radiographs were the only way to show the result of post-surgical movement (Leonard *et al*., 1985; Teerijoki-Oksa *et al*., 2002; Kriwalsky *et al*., 2008; Plooij *et al*., 2009; Oth *et al*., 2013; Aarabi *et al*., 2014; Sant'Ana *et al*., 2017; Susarla *et al*., 2020).

The advent of computerized tomography made it possible to advance both in the planning of surgeries and the verification of their results. It made it possible for the anatomical tracings obtained through surgical techniques to be checked, measured along the way, visualized if there were alterations, and even published (Leonard *et al*., 1985; Kriwalsky *et al*., 2008; Teerijoki-Oksa *et al*., 2002; Plooij *et al*., 2009; Muto *et al*., 2012; Oth *et al*., 2013; Aarabi *et al*., 2014; Sant'Ana *et al*., 2017; Susarla *et al*., 2020).

The lingual short split mandibular sagittal osteotomy, as described by Sant'Ana *et al*. (2017), follows a trend towards the sagittal osteotomy of the ramus. The shorter cut, pre lingula, allows for less bone

interference, less detachment of the pterygoid-masseteric belt, and less possibility of undue fractures ascending to the condyle (Sant'Ana *et al*., 2017; Ferri *et al*., 2019; Susarla *et al*., 2020).

Muto *et al*. (2012) and Plooji *et al*. (2009), carried out innovative studies, specifically to determine the lingual fracture tracing, already emphasizing the possibilities of variation that occurred for the Hunsuck (1968) technique.

This study assigned the classification from 1 to 4 based on the design of the surgical tracing of the osteotomy, type 1 when it was exactly like the original technical proposal, type 2 with little variation in tracing, and type 3 with no fracture to the lower base of the mandible or with it following from the posterior cortex of the ramus and type 4 is similar in design to type 2, but with fragmentation.Clinically, these tracing differences were not visualized by the surgeons, which did not cause any interference or change in conduct during the surgery.

Plooji *et al*. (2009), in their study found 4 classifications, but in no case of the lingual short split osteotomy tracing was their ascendance to the condyle and TMJ, as in his variable LSS4, corresponding to 2.5 % of his sample. The research found similarity with the original technical description (type 1 classification) in 73.33 % of the drawings, a percentage well above that described by Plooji *et al*. (2009) for the original Hunsuck (1968) technique. Therefore, the predictability is much higher for the lingual short split technique and the possibility of alterations is lower.

The type 2 classification of our study was viewed 11 times or 18.33 % of the sample. This tracing is similar to the original technique drawing, but with a descending trace a little further toward the back. It is a very stable design and very similar to Santana e Souza's technical proposal (Lloyd *et al*., 2011; Dreiseidler *et al*., 2016; Sant'Ana *et al*., 2017; Tengku Shaeran el al., 2017; Valls-Ontañón el al., 2020).

Type 3 classification was found in 4 osteotomies or 6.66 % of the sample. This tracing had a very similar design to that of Dal Pont (1961) and with the LSS2 classification by Plooji *et al*. (2009).

Regarding sex, there was a slight predominance in the sample of the classification of the tracing type 1 for females, type 2 for males, type 3 for the same number, and 1 type 4 osteotomy for males.

Also, it was observed in the CT scans that types 1 and 2 have very similar designs and trace follow-up with little variation. As type 1 with 73.33 % and type 2 with 18.33 % totaled 91.66 % of the sample, we can idealize that the lingual short split technique complies with the criteria of eligibility and predictability, with a high percentage of reliability concerning its original design or minimal variation, without interfering with its results in terms of stability or loss of osteosynthesis.

Through this prospective analysis of CT scans of mandibles operated by the lingual short split technique for sagittal mandible osteotomy, it can be concluded that:

There were no important statistical differences regarding the classifications of the types of fracture designs visualized in CT scans related to age group, sex, or laterality, and a new classification was obtained for lingual fractures based on lingual short split mandibular osteotomy (1, 2, 3, and 4). The tomography evaluation methodology allowed good visualization of the lingual tracing of the short split technique, proving to be predictable and with a high percentage of fidelity to the original design in the sample performed. This osteotomy presents better behavior and a more stable tracing on its tongue board than the Hunsuck (1968) technique, evaluated in other techniques.

There is a need to correlate the tracing variables found with clinical studies, showing whether these alterations could cause a greater or lesser degree of post-surgical impairment.

PIMENTA E SOUZA, D.; SHINOHARA, E.; BUYSSE TEMPRANO, A. V.; SANT'ANA, E. Evaluación tomográfica después de la cirugía ortognática mandibular: Técnica de división lingual corta. *Int. J. Odontostomatol., 18(3)*:360-366, 2024.

RESUMEN: La osteotomía sagital de mandíbula es una técnica de rutina en cirugía ortognática; algunas modificaciones han sido realizadas en el tiempo. La osteotomía de división corta muestra una modificación en el diseño lingual siendo mas corto y bajo de la língula, lo cual se relaciona con pocas complicaciones. Por mucho tiempo, las radiografías fueron utilizadas exclusivamente para evaluar el diseño de las osteotomías siendo que el trazado lingual no podía ser evaluado. La tomografía computadorizada (TC) permite la evaluación de diseños de fracturas quirúrgicas, haciendo posible el visualizar los resultados postoperatorios. Se realizó un estudio prospectivo utilizando 60 TC de pacientes operados utilizando la técnica de división corta, incluyendo variables relacionadas con la técnica de corte lingual. Como resultado se observó que el 73,33 % fue de

tipo 1, el 18,33 % fue de tipo 2, el 6,66 % fue de tipo 3 y el 1,66 % fue de tipo 4. Las de tipo 1 y 2 son líneas de fractura similares a la técnica original; tipo 3 presenta una pequeña variación y tipo 4 presenta fragmentación. Podemos concluir que la técnica es predecible, sin diferencias significativas entre las variables analizadas, con una buena visualización del trazado utilizando el presente método. Una nueva clasificación de la técnica es recomendadas y es necesario correlacionarla con los resultados clínicos de estudios futuros.

PALABRAS CLAVE: cirugía ortognática, osteotomía mandibular, división lingual corta, osteotomía sagital de rama.

REFERENCES

Aarabi, M.; Tabrizi, R.; Hekmat, M.; Shahidi, S. & Puzesh, A. Relationship between mandibular anatomy and the occurrence of a bad split upon sagittal split osteotomy. *J. Oral Maxillofac. Surg., 72(12)*:2508-13, 2014.

Arnett, G.W. A redefinition of bilateral sagittal osteotomy (BSO) advancement relapse. *Am. J. Orthod. Dentofacial Orthop., 104(5)*:506-15, 1993.

Bell, W.H. & Schendel, S.A. Biologic basis for modification of the sagittal ramus split operation. *J. Oral Surg., 35(5)*:362-9, 1977.

Beukes, J.; Reyneke, J.P. & Becker, P.J. Variations in the anatomical dimensions of the mandibular ramus and the presence of third molars: its effect on the sagittal split ramus osteotomy. *Int. J. Oral Maxillofac. Surg., 42(3)*:303-7, 2013.

Böckmann, R. A. *Modification of the mandibular split based on a physical model: experimental animal and clinical studies.* Doctoral Thesis, (Maastricht University). Datawyse / Universitaire Pers Maastricht. Availible online: https://cris.maastrichtuniversity.nl/en/publications/modification-of-the-mandibular-split-based-on-a-physical-model-ex

Böckmann, R.; Meyns, J.; Dik, E. & Kessler, P. The modifications of the sagittal ramus split osteotomy: a literature review. *Plast. Reconstr. Surg. Glob. Open., 2(12)*:271, 2015.

Cunha, G. *Influência da anatomia óssea no padrão de separação da osteotomia sagital do ramo mandibular*. Dissertação (Mestrado em ciências odontológicas), Universidade Estadual Paulista "Júlio de Mesquita Filho", Faculdade de Odontologia, Araraquara, 2018. Available online: https://repositorio.unesp.br/server/api/core/bitstreams/d34c517b-ee9e-4b6e-9a7b-729c91522b35/content

Cunha, G.; Oliveira, M.R.; Salmen, F.S.; Gabrielli, M.F.R. & Gabrielli, M.A.C. How does bone thickness affect the split pattern of sagittal ramus osteotomy?. *Int. J. Oral Maxillofac. Surg., 49(2)*:218-23, 2020.

Dal Pont, G. Retromolar osteotomy for the correction of prognathism. *J. Oral Surg. Anesth. Hosp. Dent. Serv., 19*:42-7, 1961.

Dreiseidler, T.; Bergmann, J.; Zirk, M.; Rothamel, D.; Zöller, J.E. & Kreppel, M. Three-dimensional fracture pattern analysis of the Obwegeser and Dal Pont bilateral sagittal split osteotomy. *Int. J. Oral Maxillofac. Surg., 45(11)*:1452-58, 2016.

Epker, B.N. Modifications in the sagittal osteotomy of the mandible. *J. Oral Surg., 35(2)*:157-9, 1977.

Ferri, J.; Schlund, M.; Roland-Billecart, T. & Nicot, R. Modified mandibular sagittal split osteotomy. *J. Craniofac. Surg., 30(3)*:897-9, 2019.

Hu, J.; Song, Y.; Wang, D.; Yuan, H.; Jiang, H. & Cheng, J. Patterns of lingual split and lateral bone cut end and their associations with neurosensory disturbance after bilateral sagittal split osteotomy. *Int. J. Oral Maxillofac. Surg., 49(5)*:595-601, 2020.

Hunsuck, E.E. A modified intraoral sagittal splitting technic for correction of mandibular prognathism. *J. Oral Surg., 26(4)*:250-3, 1968.

Kriwalsky, M.S.; Maurer, P.; Veras, R.B.; Eckert, A.W. & Schubert, J. Risk factors for a bad split during sagittal split osteotomy. *Br. J. Oral Maxillofac. Surg., 46(3)*:177-9, 2008.

Leonard, M.S.; Ziman, P.; Bevis, R.; Cavanaugh, G.; Speidel, M.T. & Worms, F. The sagittal split osteotomy of the mandible. *Oral Surg. Oral Med. Oral Pathol., 60(5)*:459-466, 1985.

Lloyd, T.E.; Drage, N.A. & Cronin, A.J. The role of cone beam computed tomography in the management of unfavourable fractures following sagittal split mandibular osteotomy. *J. Orthod., 38(1)*:48-54, 2011.

Muto, T.; Takahashi, M. & Akizuki, K. Evaluation of the mandibular ramus fracture line after sagittal split ramus osteotomy using 3-dimensional computed tomography. *J. Oral Maxillofac. Surg., 70(11)*:648-52, 2012.

Oth, O.; Louryan, S.; Van Sint Jan, S.; Rooze, M. & Glineur, R. Impact of the mandibular divergence on the position of the inferior alveolar nerve and mylohyoid nerve: a computed tomography study and its relevance to bilateral sagittal split osteotomy. *Surg. Radiol. Anat., 35(3)*:241-7, 2013.

Pereira, F.L.; Janson, M. & Sant'Ana, E. Hybrid fixation in the bilateral sagittal split osteotomy for lower jaw advancement. *J. Appl. Oral Sci., 18(1)*:92-99, 2010.

Plooij, J.M.; Naphausen, M.T.; Maal, T.J.J.; Xi, T.; Rangel, F.A.; Swennnen, G.; de Koning, M.; Borstlap, W.A. & Bergé, S.J. 3D evaluation of the lingual fracture line after a bilateral sagittal split osteotomy of the mandible. *Int. J. Oral Maxillofac. Surg., 38(12)*:1244-9, 2009.

Puricelli, E. A new technique for mandibular osteotomy. *Head Face Med., 3*:15, 2007.

Sant'Ana, E.; Souza, D. P.E.; Temprano, A.B.; Shinohara, E.H. & Faria, P.E.P. Lingual short split: A bilateral sagittal split osteotomy technique modification. *J. Craniofac. Surg., 28(7)*:1852-54, 2017.

Susarla, S.M.; Cho, D.Y.; Ettinger, R.E. & Dodson, T.B. The low medial horizontal osteotomy in patients with atypical ramus morphology undergoing sagittal split osteotomy. *J. Oral Maxillofac. Surg., 78(10)*:1813-19, 2020.

Teerijoki-Oksa, T.; Jääskeläinen, S.K.; Forssell, K.; Forssell, H.; Vähätalo, K.; Tammisalo, T. & Virtanen, A. Risk factors of nerve injury during mandibular sagittal split osteotomy. *Int. J. Oral Maxillofac. Surg., 31(1)*:33-9, 2002.

Tengku Shaeran, T.A.; Shaari, R.; Abdul Rahman, S.; Alam, M.K. & Muhamad Husin, A. Morphometric analysis of prognathic and non-prognathic mandibles in relation to BSSO sites using CBCT. *J. Oral Biol. Craniofac. Res., 7(1)*:7-12, 2017.

Valls-Ontañón, A.; Ascencio-Padilla, R.D.J.; Vela-Lasagabaster, A.; Sada-Malumbres, A.; Haas-Junior, O.L.; Masià-Gridilla, J. & Hernández-Alfaro, F. Relevance of 3D virtual planning in predicting bony interferences between distal and proximal fragments after sagittal split osteotomy. *Int. J. Oral Maxillofac. Surg., 49(8)*:1020-28, 2020.

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