

EVALUATION OF TWO METHODS USED TO RECORD THE NEUTRAL ZONE UTILIZED LOW FUSING MODELING COMPOUND- ACCURACY OF CENTRIC RELATION REGISTRATION

Aisha Zakaria Hashem Mustafa*

ABSTRACT

Introduction: Many techniques have been described in the literature for molding of the Neutral zone. Gothic arch tracer attached to neutral zone record used for accurate registration of centric relation.

Material and method: This study was passed on 10 edentulous patients to compare the accuracy of centric relation using intra-oral Gothic arch tracer attached to two different neutral zone records. The first method includes, recording of neutral zone for each arch separately without vertical stopper then orientation of the occlusal plane on the articulator (indirect method), the other method record the neutral zone at predetermined vertical relation, using upstanding flange, then orient the occlusal plane intra- orally (direct method).

Result: within this study, the indirect method of neutral zone exhibit a statistically more accuracy in registration of the centric relation using the Gothic arch tracer compared to the direct method.

Conclusion: recording the neutral zone of each arch separately give more accurate registration of the centric relation than that using upstanding flange.

INTRODUCTION

The goal of complete denture prosthesis should be restoring the patient function comfortably and proficiently in coordination with the stomatognathic muscles and the temporomandibular joints. The Neutral Zone Technique is an approach for improving the quality of complete denture¹⁻³.

Complete denture therapy objectives include the functional and esthetic replacement of missing

dentition⁴. In addition to replacing missing oral tissues, complete dentures serve to redefine true spaces within the oral cavity. Accurate denture base contour and appropriate denture tooth position to improve the prosthesis retention, stability, phonetics, esthetics, function and patient comfort⁵⁻¹⁷. Complete dentures constructed according to the neutral zone are enhanced especially in patients where the implants cannot be used¹⁸.

* Lecturer of Prosthodontics, Faculty of Dentistry, Mansoura University.

Neutral zone records are valuable for using in patients affected by neuromuscular decline or decreasing facial muscle tonicity, anatomic abnormality or inadequacy, such as in surgical resections¹⁹⁻²² or those suffering facial neuromuscular discrepancy or Parkinson's disease.²³

Many techniques are used to record neutral zone to construct a denture in muscle balance. These techniques use a soft, moldable material to be placed in the mouth and patients performing functions with their lips, cheeks and tongue in order to capture neutral zone within the lips, cheek and tongue. The low fusing impression compound is one of the best materials used for neutral zone record. Also, tissue conditioner, silicon impression material²⁴⁻²⁸, and irreversible hydrocolloid is used²⁹.

The external contours of the denture in addition to teeth positions are determined by muscle function during the neutral zone procedure. These are molded by the size and function of the tongue and tonus of the lips and cheeks^{30,31,32}. Functional molding the occlusion rim by the patient into the neutral zone area, result in a more stable record base during maxillomandibular relation record³³.

Graphic technique is one of the accurate methods used to determine centric relation with mechanical instrument.³⁴ one of the advantages of Gothic arch tracer is that the centric relation record is verified at the jaw relation registration appointment³⁵

The accuracy of recording centric relation is higher by using the gothic arch method than the other conventional methods.³⁶ Stabilization of record blocks with the neutral zone method is one of the important factors for accuracy of recording centric relation with Gothic arch tracer.³⁷

This study evaluate the accuracy of centric relation record using intraoral Gothic arch tracer for two different methods used for recording the neutral zone. The first method allow recording of neutral zone without vertical stopper (indirect method)

while the second method allow recording the neutral zone at a predetermined vertical relation (direct method).The null hypothesis of this study was that there is no difference between the two methods of neutral zone in recording the centric relation using the gothic arch tracer.

MATERIALS AND METHODS

Clinical trial

This study was a prospective clinical trial to compare verifies the centric relation position using Gothic arch tracer attached to two different neutral zone records by two techniques. Sample size of 10 completely edentulous healthy male subjects was calculated using PASS 2008 Software aimed at paired t-test, has a power of 0.80 at alpha (α) of 0.05.

The subjects were male in good health without any disease of the muscles with age range from 60 to 70 years and selected from the clinic of prosthodontics in the Mansoura University.

For every subject, 2 set of maxillary and mandibular record base were constructed on the same master caster. Each one was used for recording the neutral zone with a different method.

Neutral zone records fabrication

Conventional record bases were constructed on the master casts and jaw relations were recorded by interocclusal wax check bite method. Mounting were done on mean value articulator. This mounting was used for construction of the upstanding flange (fig 1 A, B).

The maxillary and mandibular master casts were used to fabricate 2 set of self cure acrylic resin maxillary and mandibular record base. The first set of record base was constructed with addition of wrought wire loops that aid in retention of soft compound rim to acrylic record base during record the neutral zone using the 1st method. The second set of record base was constructed with upstanding

acrylic flange at the correct vertical dimension of occlusion to record neutral zone by the 2nd method (fig 2 A, B).

Low fusing modeling plastic (Green Tracing sticks, Kerr, Germany) impression compound was used for the clinical registration of the neutral zone using swallowing technique.

For the 1st method, without vertical stopper, the registration of the neutral zone in each arch was done without the opposing record block. The biomechanical orientation of the occlusal plane on the maxillary record was done according to the previous mounting. After this, the excess modeling plastic impression compound up to the mandibular intended occlusal plane was adjusted against the maxillary one until the compound rims had even bear at a predetermined vertical dimension of occlusion (fig 3 A, B). The stability of record blocks were checked intraorally (fig 4).

For the second method, with vertical stopper, the 2nd sets of record base with upstanding flange were used for recording the neutral zone using swallowing technique but with the intraoral presence of the opposing base during recording the neutral zone (fig 5). Intraorally, the anterior excess modeling plastic impression compound was trimmed.

Centric relation establishment

Centric relation established by using Gothic arch tracer attached to 1st set of neutral zone record in accurate position. The patient was instructed to carry out severe protrusive and lateral excursions while the central bearing pointer contacts the tracing plate lightly. accurate registration of centric relation was revealed by a definitive sharp apex.

The point of the apex represent the centric relation position. To record centric relation intraorally, a metal disc with a small central hole was located to be coincided with the apex of the needle-point trac-



Fig. (1) A. Recording jaw relation and B. mounting on the mean value articulator.

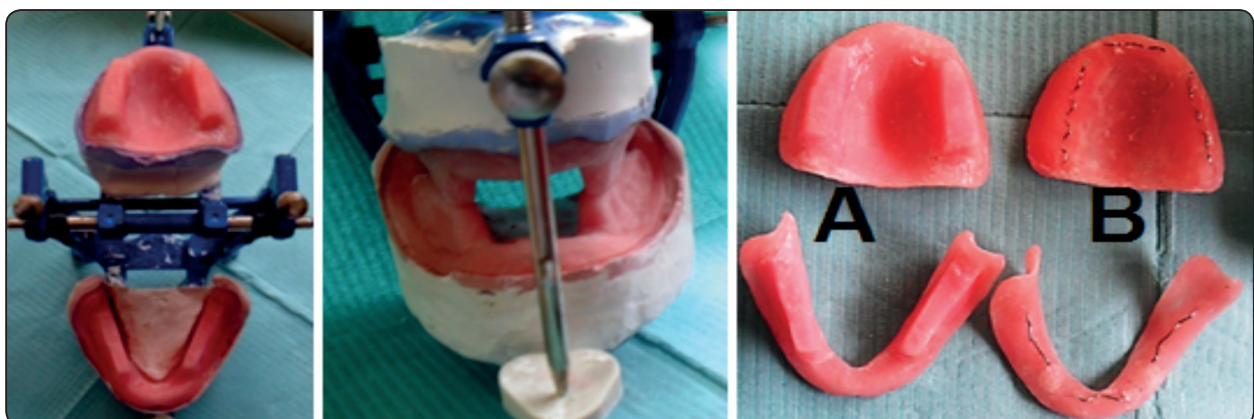


Fig. (2) Record bases for neutral zone with upstanding flange (A) and wrought wire loops (B) to retain soft compound.

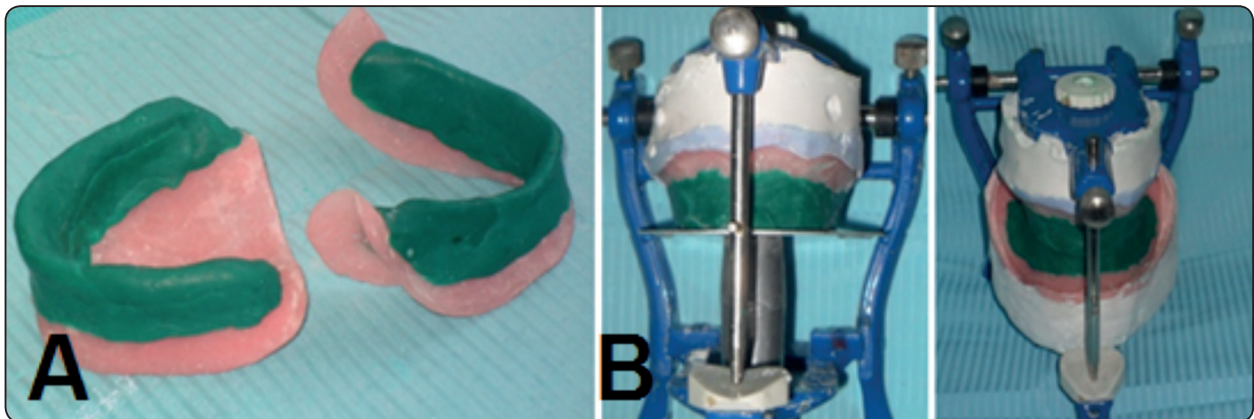


Fig. (3) A) The neutral zone record with first method extraorally. B) Record blocks of neutral zone after trimming to the occlusal plane.



Fig 4. Neutral zone record after trimming to accurate height (intraorally).

ing. The patient was requested to hold the central bearing point in this small as lightly as possible until the centric relation was recorded. Mandibular cast were remounted with the aid of this record.

Intraoral Gothic arch tracer was attached to the 2nd sets of neutral zone record with upstanding flange and centric relation were established as described previously. After gothic arch tracing, the apex point of centric relation was colored with red color and the remaining of tracing was removed by coating with blue inlay wax. Then the record blocks returned to the articulator. The articulator was closed. The second point represent the centric relation of the 1st method. The vertical distance from each point and a fixed point which are the margin of the tracing plate was measured and recorded (fig 6. A, B).

Statistical analysis of the results

The recorded values were charted and analyzed statistically using SPSS ver. 17.0® (Statistical



Fig. (5) The neutral zone record with second method extraorally.

Package for Scientific Studies). Shapiro test was used to evaluate the normality of the continuous data. Paired t-test was used to compare between the values of the distance of the centric relation point to a fixed point for each set (the indirect and direct method) of the neutral zone. Results were considered significant at $p \leq 0.05$.

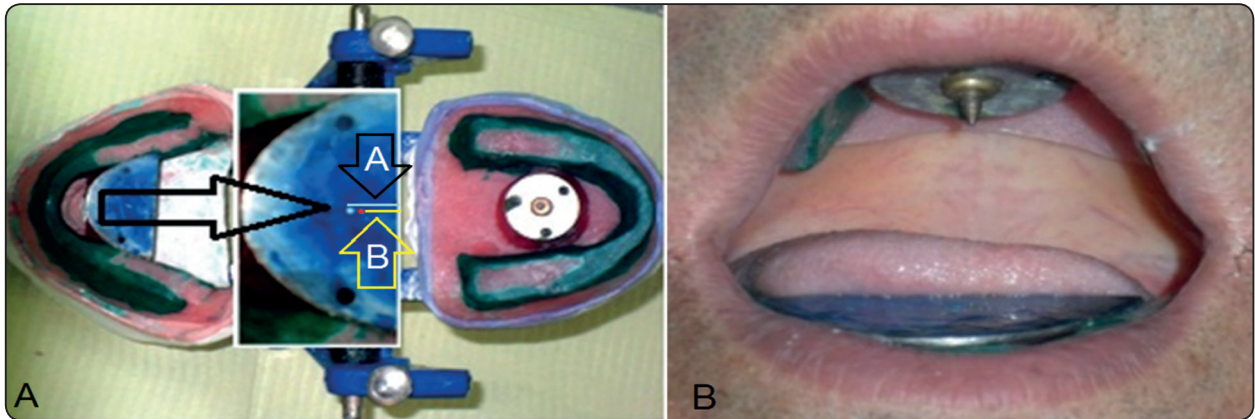


Fig. (6) The verification of centric relation using Gothic arch tracer. A) The distance A: centric relation of the 1st method. B. centric relation for 2nd method. B) Gothic arch tracer attached to neutral zone intraorally.

RESULTS

Statistical findings

Parametric continuous data was revealed by Shapiro tested for normality. The comparison of the centric relation of 1st (indirect) and 2nd (direct) methods of the neutral zone for individual subjects

revealed a statistically significant difference between the 2 groups ($P < 0.0001$). Also, the differences between the two techniques were showed a statistically significant difference ($P < 0.0001$) as shown in Table 1.

The 1st method revealed a more posterior centric relation than that for the 2nd method.

TABLE (1) The mean, (standard deviation) and paired t-test for Comparing of the centric relation of 1st (indirect) and 2nd (direct) methods of the neutral zone. One sample t- test was used to analyze the difference between the two techniques. (n = 10).

	The distance to the point of centric relation in 1st neutral zone technique	The distance to the point of centric relation in 2nd neutral zone technique	The difference between the two techniques
Mean	11.025	10.350	0.675
Standard deviation	1.25	1.13	0.29
t	7.364		7.364
p	0.0001*		0.0001*

*Significant if $P < 0.05$

DISCUSSION

The results of this study reject the null hypothesis where there was a difference between the two neutral zone methods in recording the centric relation

The neutral-zone philosophy is built upon the theory that a specific area, within the denture space, where the muscular function will seat the denture and where forces from outside are neutralized by the forces from inside ³².

Two techniques described here for recording the physiologic dynamic forces of perioral and oral muscles during function. Then this data was used to stabilize the record blocks during the centric relation record by Gothic arch tracer as mentioned by Alfano and Leupold ³³.

The neutral zone record also aids in the improvement of the stability and retention of prosthesis. ³⁸.

To achieve a functional and esthetic restoration with complete denture and to maintain the health of remaining tissues, accurate record of maxillomandibular relations must be done. In complete denture creation, the most essential maxillomandibular relation is the centric relation of the mandible to the maxilla. Accurate record of this relation is important to allow the harmony of the occlusion with mandibular movement ³⁴.

In complete denture production, neither the initial description of retruding theory for centric relation nor the modern explanation of the anterior bracing of the condyle has neither obvious variations on the objective or the practice of centric relation recording ³⁹.

Registration of mandibular centric relation using the Gothic arch tracing technique is a stable method **40**. Stabilization of record blocks with the neutral zone record is important factor for correct centric relation record using Gothic arch tracer ³⁷.

In this study, significant difference was founded

in the accuracy of recording the centric relation using the Gothic arch tracer between the two methods used for recording the neutral zone. The indirect method (articulator method) was more accurate than the direct method. This may be attributed to that the recording neutral zone of each arch separately allow the excess compound material to escape in the height so, give more accurate record and more stable record during centric relation registration than in the second method when the neutral zone recorded for each arch with opposing upstanding flange so the excess material escape in the width giving a wider record.

In addition to this, the direct method can lead to distortion of the recorded neutral zone if softening of compound or addition were done during orientation of the occlusal plane anteriorly.

Cagna et al, 2009 stated that: Exclusion of use a maxillary record base during clinical registration of the mandibular neutral zone is essential, as eliminating the maxillary record base and rim avoids compressive interferences if occlusal contacts are encountered during this functional recording procedure ⁴. On the other hand, Birtles et al, 2015 found that: the neutral zone record for mandibular arch not affected by presence or absence of maxillary prosthesis in the oral cavity ⁴¹.

This study revealed that using the first method for recording the neutral zone allow recording of each arch separately then orientation of occlusal plane and establishment of centric relation using the articulator (indirect method), give accurate trimming of the excess compound without distorting the neutral zone record because this trimming done on the articulator using the mounting plate for orientation of occlusal plane. The accurate trimming of the neutral zone aids in accurate registration of centric relation using gothic arch tracer. Also, this method simplifying the neutral zone record and save the patient time.

CONCLUSION

When using the neutral zone record to obtain the centric relation, it is better to record the neutral zone without vertical stopper (indirect method) to give accurate registration of centric relation using intraoral Gothic arch tracer.

REFERENCE

- 1- Gahan MJ, Wansley AD. The neutral zone impression revisited. *Br Dent J* 2005; 198(5): 269-72
- 2- Viraj Patil R B, Hallikerimath, Shweta Magadam : Enhancement of stability for mandibular complete denture prosthesis in atrophied ridge with neutral zone technique – A case report. *J. Adv Dental Research* 2011;II (I):73-6.
- 3- Hossein Kermani, Parvin Parvaie: Neutral Zone Utilization in Complete Denture Design (An Introduction a New Technique). *J Mash Dent Sch* 2011; 35(1): 51-8.
- 4- Cagna DR, Massad JJ, Schiesser FJ, The neutral zone revisited: From historical concepts to modern application. *J Prosthet Dent* 2009;101:405-12.
- 5- Weinberg LA. Tooth position in relation to the denture base foundation. *J Prosthet Dent* 1958;8:398-405.
- 6- Bhushan P, Aras MA, Coutinho I, Rajagopal P, Mysore AR, Kumar S. Customized Cheek Plumper with Friction Lock Attachment for a Completely Edentulous Patient to Enhance Esthetics: A Clinical Report. *J Prosthodont.* 2017 Jan 25. doi: 10.1111/jopr.12591. [Epub ahead of print]
- 7- Wright CR. Evaluation of the factors necessary to develop stability in mandibular dentures. *J Prosthet Dent* 1966;16:414-30.
- 8- Brill N, Tryde G, Cantor R. The dynamic nature of the lower denture space. *J Prosthet Dent* 1965;15:401-18.
- 9- Porwal A, Sasaki K. Current status of the neutral zone: a literature review. *J Prosthet Dent.* 2013;109(2):129-34.
- 10- Kuebker WA. Denture problems: causes, diagnostic procedures, and clinical treatment. Retention problems. *Quintessence Int Dent Dig* 1984;15:1031-44.
- 11- Bhorgonde D, Nandakumar K, Khurana PR, Kumari VS, Reddy MS, Siddique S. An evaluation of the position of the neutral zone in relation to the crest of mandibular alveolar ridge - An In-vivo study. *J Int Oral Health* 2014; 6(2):45-54.
- 12- Fahmy FM, Kharat DU. A study of the importance of the neutral zone in complete dentures. *J Prosthet Dent* 1990;64:459-62.
- 13- Rehmann P, Künkel AK, Weber D, Lotzmann U, Wöstmann B. Using a Modified Neutral Zone Technique to Improve the Stability of Mandibular Complete Dentures: A Prospective Clinical Study. *Int J Prosthodont.* 2016;29(6):570-2.
- 14- Ladha KG, Gill S, Gupta R, Verma M, Gupta M. An electromyographic analysis of orbicularis oris and buccinator muscle activity in patients with complete dentures fabricated using two neutral zone techniques--a pilot study. *J Prosthodont.* 2013;22(7):566-74.
- 15- Gupta KL, Agarwal S. Salvation of a severely resorbed mandibular ridge with a neutral zone technique. *Indian J Dent Res.* 2011;22(6):883.
- 16- Afroz S, Rahman SA, Rajawat I, Verma AK. Neutral zone and oral submucous fibrosis. *Indian J Dent Res.* 2012 May-Jun;23(3):407-10.
- 17- Kuebker WA. Denture problems: causes, diagnostic procedures, and clinical treatment. Gagging problems and speech problems. *Quintessence Int Dent Dig* 1984;15:1231-8.
- 18- Rehmann P, Künkel AK, Weber D, Lotzmann U, Wöstmann B. Using a Modified Neutral Zone Technique to Improve the Stability of Mandibular Complete Dentures: A Prospective Clinical Study. *Int J Prosthodont.* 2016;29(6):570-2.
- 19- Fahmi FM. The position of the neutral zone in relation to the alveolar ridge. *J Prosthet Dent* 1992;67:805-9.
- 20- Ohkubo C, Hanatani S, Hosoi T, Mizuno Y. Neutral zone approach for denture fabrication for a partial glossectomy patient: a clinic report. *J Prosthet Dent* 2000;84:390-3.
- 21- Pekkan G, Hekimoglu C, Sahin N. Rehabilitation of the marginal mandibulectomy patient using a modified neutral zone technique: a case report. *Braz Dent J* 2007;18:83-6.
- 22- Kokubo Y, Fukushima S, Sato J, Seto K. Arrangement of artificial teeth in the neutral zone after surgical reconstruction of the mandible: a clinical report. *J Prosthet Dent* 2002;88:125-7.
- 23- Lloyd PM. Complete-denture therapy for the geriatric patient. *Dent Clin North Am* 1996;40:239-54.
- 24- Gupta A, Tomar L, Shekhawat H, Kaur N, Rana S; The Neutral Zone Impression Revisited. *JIDA* 2010; 4(12):590-2.

- 25- Lymph CD, Allen PF. Overcoming the unstable mandibular complete denture: The neutral zone impression technique. *Dental update* 2006;33(1): 21-2, 24-6.
- 26- Prithviraj DP, Singh V, Kumar S, Shruti DP: Conservative prosthodontic procedures to improve mandibular ridge. *The Journal of Indian prosthodontic society* 2008; 8(4): 178-84.
- 27- Beresin VE, Schiesser FJ: The neutral zone in complete dentures. *Principles and technique*. The C.V. Mosby Company. Saint Louis 1973; 133-141.
- 28- Makzoume JE: Morphologic comparison of two neutral zone impression techniques: A pilot study. *J Prosthet Dent* 2004;92:563-8.
- 29- Shanker SS, Umamaheswaran A, Nayar S. Biometric Denture Space- Concept of Neutral Zone Revisited Using A Hydrocolloid Impression Material. *J Clin Diagn Res*. 2015;9(11):ZD10-2.
- 30- Raybin NH. The polished surface of complete dentures. *J Prosthet Dent* 1963;13:236-9.
- 31- Devlin H. *Complete dentures: a clinical manual for the general dental practitioner*. New York: Springer-Verlag; 2002. p. 55-6.
- 32- Beresin VE, Schiesser FJ: CLASSIC ARTICLE: The neutral zone in complete dentures *J Prosthet Dent* 2006; 95:93-101.
- 33- Alfano SG, Leupold RJ: Using the neutral zone to obtain maxillomandibular relationship records for complete denture patients *J Prosthet Dent* 2001;85:621-3.
- 34- Rahn AO, Heartwell CHM : *Textbook of complete dentures*, 5th ed. Lea and febiger, philladelphia 2002; p: 287, 290
- 35- Johnson T, Wood DJ. *Techniques in complete denture technology*. Wiley Blackwell. 1st ed. 2012. pp:27.
- 36- Voborn I, Foltasov L, Zizka R, Dubovsk I, Harvan L. Centric relation registration possibilities. *IOSR Journal of Engineering (IOSRJEN)* 2016;06:1-3.
- 37- Abd El-Khalik MM, Mustafa AZ. recording centric relation using Gothic arch tracer attached to either neutral zone record blocks or wax check bite record blocks or was check bite record blocks. *E.D.J.* 2013;59(2):1303-8.
- 38- Beresin VE, Schiesser FJ. The neutral zone in complete dentures. *J Prosthet Dent* 1976;36:356-67.
- 39- HINA Z. Raja HZ, Saleem MN: Neutral zone dentures versus conventional dentures in diverse edentulous periods. *Biomedica* 2009;25(6):136-45.
- 40- Moreno JAM, Romero LL, Camacho CG, Jiménez JFC, Ruidíaz VC. Assessment of two techniques for the recording of mandibular central relationship: Gothic arch versus power centric relation. *Revista Odontológica Mexicana* 2015;19 (1): 15-26.
- 41- Birtles A, Craddock H, Kang J, Hyde TP. A Randomised Controlled Study Comparing the Anterior Mandibular Labio-Lingual Neutral Zone Position in Edentulous Subjects With and Without Their Maxillary Denture In-Situ. *Eur J Prosthodont Restor Dent*. 2015;23(2):78-84.