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ORIGINAL ARTICLE

Comparative Analysis of Sagittal Condylar Guidance Recorded by Intraoral Gothic Arch Tracing and Panoramic Radiograph in Completely Edentulous Patients

[1]Pallavi Sirana, [2]Narendra Kumar, [3]Anshu Malhotra, [4]Nandini Singhal, [5]Nisha Chaudhary

ABSTRACT

Aim: To compare the intraoral gothic tracing method with panoramic radiographs in patients requiring complete dentures.

Materials and methods: The present study was conducted on 20 edentulous subjects of both genders. Hanau Wide-Vue semi-adjustable articulator was used to record sagittal condylar guidance in all patients. Panoramic radiographs were taken in all patients and Frankfurt horizontal plane was traced on both sides of orthopantomogram (OPG) and second plane was marked by joining the most superior and most inferior point on the glenoid fossa curvature. Frankfort's horizontal plane was crossed with this line to record radiographic condylar guidance angle. NNT software was used to record the condylar guidance angle.

Results: Mean ± standard deviation (SD) clinical SCG (25.15 ± 3.24) and radiographic seismocardiography (SCG) (27.54± 5.01) was non significant ($p > 0.05$) on left side. Mean ± standard deviation (SD) clinical SCG (26.84 ± 3.69) and radiographic SCG (29.3 5 ± 4.58) was significant ($p < 0.05$) on right side. The SCG did not show difference in values recorded by both methods on both sides. The difference in values in both sides by clinical method and radiographic method was non-significant ($p > 0.05$).

Conclusion: There was correlation between sagittal condylar guidance obtained by both intraoral gothic arch method as well as radiographic method done on digital panoramic radiographs.

Clinical significance: Correct centric jaw relation determines the success of the complete denture. Radiographic and clinical methods provide sufficient minute details necessary for the betterment of management.

Keywords: Intraoral gothic arch, Panoramic radiographs, Sagittal condylar guidance.

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[1-4]Department of Prosthodontics and Crown and Bridge, Institute of Dental Studies and Technologies, Modinagar, Ghaziabad, Uttar Pradesh, India

[5]Department of Prosthodontics and Crown and Bridge, PDM Dental College and Research Institute, Bahadurgarh, Haryana, India

Corresponding Author: Pallavi Sirana, Department of Prosthodontics and Crown and Bridge, Institute of Dental Studies and Technologies, Modinagar, Ghaziabad, Uttar Pradesh, India, Mobile: +919582388501, e-mail: dr.pallavisirana@gmail.com

INTRODUCTION

The management of complete edentulous patients has options such as complete denture and implant supported denture. The fabrication of complete denture overcomes the difficulty encountered by patients due to missing teeth. A good quality complete denture is sufficient to restore all the functions of oral cavity. However, there can be variation in the response to complete denture and that is subjective in nature.[1]

There are certain factors which affects insertion of complete denture in edentulous patients. Correct recording of border and jaw relations determines the future outcome of the treatment. Incorrectly recorded maxilla-mandibular jaw relations leads to failure and difficulty in performing functions such as biting, chewing etc. Various studies have documented several methods of recording centric relation such as functional, static, graphic and cephalometric. The choice of method is operator specific. However, graphical and static methods are most preferred among dentists.[2,3]

Functional recording is done while patients perform all the functions such as protrusion, retrusion, left and right lateral movements. Record bases should be

very stable during this procedure and neuromuscular coordination need to be in harmony. Static or direct method is the oldest direct interocclusal record method. In this method wax or thermoplastic material is inserted between the ridges and patient is asked to bite on it.[4]

Graphical method can be intraoral or extraoral depending upon the placement of recording device. It is useful in recording eccentric relation maxilla with mandible. Gothic arch tracing is one of the graphic method widely used except in cases of arthopathy, reduced inter-arch space etc. Hence panoramic radiographs can be used for recording condylar guidance angle.[5] The present study was conducted to compare the intraoral gothic tracing method with panoramic radiographs in patients requiring complete dentures.

MATERIALS AND METHODS

The present study was conducted in the Department of Prosthodontics, Crown and Bridge, Institute of Dental Studies and Technologies, Modinagar, Ghaziabad, Uttar Pradesh. It consisted of 20 edentulous subjects (males–12, females–8) of age ranged 35 to 60 years both genders. Patients with temporomandibular disorders or conditions affecting hard tissues were excluded from the study. All were informed regarding the study and written consent was obtained. Ethical clearance was obtained prior to the study.

General information such as name, age, gender etc. was recorded. Primary impression was taken with impression compound and the cast was poured with plaster of paris. Special tray was formed with acrylic base plate and border molding was done using green sticky wax. After this, secondary impression was obtained with zinc oxide eugenol paste. Secondary cast was prepared with impression plaster. Occlusal rims were made on secondary cast in order to record the jaw relation.

In present study, Hanau Wide-Vue semi-adjustable articulator was used. A standardized method of face bow recording was adopted and indirect technique for mounting maxillary cast was used. After this, with the help of centric relation record mandibular cast was mounted to articulator and the intraoral tracers were fixed to the occlusion rims. On maxillary occlusal rim, center-bearing plate and on mandibular occlusal rim, center bearing point was fixed (Fig. 1).

The horizontal inclinations of the condylar guidance and centric locks were slightly loosened on the articulator. The protrusive interocclusal records were used to program the articulator. On the lower occlusal rim, the record was seated and onto the imprint of occlusal record, the upper member was guided. Simultaneously, the right and left condylar guidance were moved in to and fro motion for correctly seating the upper and lower rims into the protrusive relation record. Condylar guidance on both the sides of articulator was set (Fig. 2).

Panoramic radiographs were taken in all patients and NNT software was used to record the condylar guidance angle. Frankfurt horizontal plane was measured on both sides of OPG and the superior most and inferior most point on the glenoid fossa curvature was marked for forming second plane which then moved to cross the frankfort's horizontal plane to achieve radiographic condylar guidance angle (Fig. 3). Results thus obtained were subjected to statistical analysis using Chi-square test. A p-value less than 0.05 was considered significant.

Results

Table 1 shows SCG measured on both left and right side with clinical method and radiographic method. There was no statistical difference in either of method between left and right side ($p > 0.05$).

Table 2 shows that on left side, mean ± SD clinical SCG was 25.15 ± 3.24 and radiographic SCG was 27.54 ± 5.01. On right side, mean ± SD clinical SCG was 26.84 ± 3.69

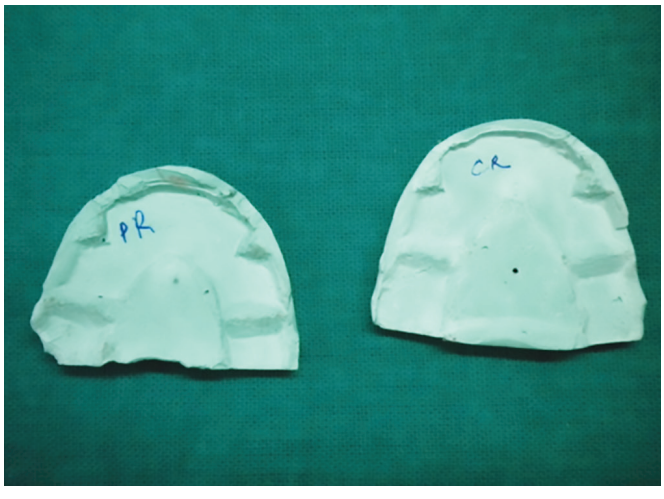

Fig. 1: Both centric record and protrusive interocclusal records

Fig. 2: The protrusive interocclusal records on articulator

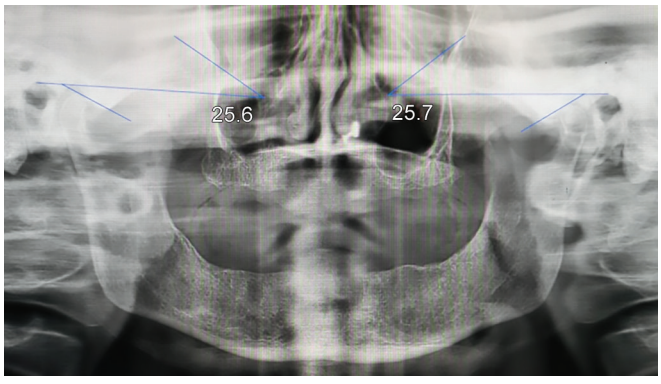

Fig. 3: Sagittal condylar guidance on panoramic radiograph

Table 1: Measurement of SCG by intraoral gothic arch tracing and radiographic method

Patient	*Right clinical SCG*	*Left clinical SCG*	*Right radiographic SCG*	*Left radiographic SCG*
1	26	25	30.5	25.7
2	27	26	32.4	23.6
3	30	26	25.6	24.2
4	28	25	27.8	31.1
5	29	26	29.4	30.2
6	25	27	22.5	32.3
7	25	30	24.7	35.2
8	26	25	28.9	30.5
9	27	26	30.2	24.2
10	28	25	34.3	25.9
11	30	28	32.6	23.1
12	25	29	30.7	22.8
13	26	26	32.9	21.1
14	28	30	25.6	22.4
15	25	25	24.2	22.4
16	26	26	23.1	23.1
17	28	25	22.5	32.9
18	27	27	23.7	27.4
19	26	26	30.0	22.2
20	28	25	31.4	21.1
Mean ± SD	26.84 ± 3.69	25.15 ± 3.24	29.35 ± 4.58	27.54 ± 5.01

Table 2: Comparison of sagittal condylar guidance with intraoral gothic arch tracing method and radiographic method

Side	*Mean*	*SD*	*p-value*
Left			
Clinical SCG	25.15	3.24	0.12
Radiographic SCG	27.54	5.01	
Right			
Clinical SCG	26.84	3.69	0.01
Radiographic SCG	29.35	4.58	

and radiographic SCG was 29.35 ± 4.58. The difference on right side was significant (p = 0.01).

RESULTS

Table 1 shows SCG measured on both left and right side with clinical method and radiographic method. There was no statistical difference in either of method between left and right side (p > 0.05).

Table 2 shows that on left side, mean ± SD clinical SCG was 25.15 ± 3.24 and radiographic SCG was 27.54 ± 5.01. On right side, mean ± S.D clinical SCG was 26.84 ± 3.69 and radiographic SCG was 29.35 ± 4.58. The difference on right side was significant (p = 0.01).

DISCUSSION

Gothic arch tracing is the technique in which left and right condyles forms an arch which is intersected. With the advent of various modifications over a period of time, this technique has become popular among dentists. Hence this method has revolutionarized in the field of dentistry. Silverman[6] in his study of fallacies of concepts of centric occlusion used tracing plate in which patients were made to bite. In his study, biting point of the patient was located with the help of intra oral gothic arch tracer. Author substantiated the role of muscles in retrusion of the mandible.

In present study, the intraoral gothic tracing method was compared with panoramic radiographs in patients requiring complete dentures. Both the methods were almost similar in terms of time consumed in recording SCG. Intraoral gothic tracing method is one of the accurate methods of recording centric relation. The intraoral tracings cannot be observed during the tracing, hence this method is getting replaced by other methods. Other shortcoming is lack of equal pressure, it is not effective in patients with prognathic maxilla or mandible. Macroglosia and flabby ridges are other limitations of the method. On the contrary, all these factors do not affect radiographic method but this method is technique sensitive. Moreover, panoramic radiographs also uses harmful X-rays which may show its deleterious effects on both soft and hard tissue of oral cavity.

Gilboa et al.[7] in their study assessed the panoramic radiographic images and articular morphology for recording condylar guidance. Authors used dry human skulls for the study. A positive correlation was found between radiographic and clinical method in their study. However, they suggested that radiographic methods are better in terms of standardization and effective measurements may be performed on it.

In present study we included 20 patients (males–12, females–8) who required complete denture. We compared clinical method of jaw recording with radiographic method. Mean clinical SCG was 25.15 and radiographic SCG was 27.5 on left side whereas it was 26.84 clinically and 29.35 radiographically on right side. On right side, a significant (p <0.05) difference was observed in both techniques. Our results are in agreement with Weinberg[8] who evaluated concepts of basic articulators and found a positive correlation between radiographic and clinical method.

Nandini et al.[9] in study analyzed chandra tracer, hight tracer, functiograph, intraoral tracer and check bite method found no significant difference among all. In graphic recording methods, the central bearing point should be at centre to avoid displacement of record base. In patients with less bone height, the horizontal force may unstable the record base.[10] Hence care should be taken in cases of minimal residual alveolar ridges. Even with the flabby or loose ridges with excessive soft tissue overgrowth, the stability of record base is compromised.[11]

Christensen[12] in their study advocated the methods of sagittal condylar guidance. Author found radiographic method better against clinical method. He found higher SCG value radiographically as compared to intraoral method. The manual method was used in his study whereas in present study digital radiographic tracing was done with NNT software. Hence the chances of error were negligible in present study as compared to his study.

Eccentric relation of maxilla with mandible can be recorded with graphic method. It is one of the accurate method of recording centric relation. Lee et al.[13] in their study compared condylar guidance by two techniques such as checkbite and ARCUS digma 2. They found no statistically significant difference between both genders. A statistically significantly difference does existed between the lateral condylar inclinations of ARCUS digma 2 than checkbite method.

Donegan[14] in his study assessed the sagittal condylar guidance with the help of wear facets and protrusion records found symmetrical SCG angle both left and right side. Stramotas[15] in his study used panoramic radiographs in determination of linear and angular measurements. Author suggested that radiographic method is better in recording centric jaw relation however, a slight error in orientation of reference plane may vary the values. Gray et al.[16] conducted a study in which transcranial radiographs of the temporomandibular joint was taken. Authors suggested that panoramic radiographs are efficient and effective in providing SCG on both left and right side. The advantage of panoramic radiographs is that both sides can be visualized on the same image. The only limitation is slight magnification on the right side of the image.

Shreshta et al.[17] in their study calculated the horizontal condylar guidance using clinical and radiographic methods. Three clinical methods such as protrusive method, intraoral central bearing device and Lucia jig record was compared with CT scan method on 12 patients age ranged 20 to 40 years. Nonsignificant difference was observed on left and right side. Authors found strong association between jig and wax method. CT scan values were slight higher than clinical values.

Brewka[18] conducted a study assessed cephalometric hinge axis with panoramic radiographs found alteration in clinical as well as radiographic values of sagittal condylar guidance values. Thakur et al.[19] conducted a clinical study to record static and functional methods for recording centric relation and condylar guidance using interocclusal wax and extraoral gothic arch tracing and found that gothic arch tracing had higher values as compared to wax record on both right and left side. It recorded centric relation more posterior than the static method. However, horizontal condylar guidance was similar with both gothic arch tracing method and interocclusal wax method.

CONCLUSION

There was correlation between sagittal condylar guidance obtained by both intraoral gothic arch method as well as radiographic method done on digital panoramic radiographs. Both techniques found to be effective in recording relation. Panoramic radiographs may be useful in cases where other method poses difficulty to record relation.

CLINICAL SIGNIFICANCE

Radiographic (panoramic) and clinical methods prove to be effective in recording details required in fabrication of complete denture. Correct centric jaw relation determines the success of the complete denture.

REFERENCES

1. Shetty S, Satish Babu CL, Tambake D, Surendra Kumar GP, Setpal AT. A comparative evaluation of condylar guidance value from radiograph with interocclusal records made during jaw relation and try-in: A Pilot study. J Indian Prosthodont Soc 2013;13:321-326.
2. Zarb GA, Bolender CL, Eckert SE, Fenton AH, Jacob RF, Mericske-Stern R. Prosthodontic treatment for edentulous patients: complete dentures and implant-supported prostheses. 12th ed. St. Louis: Mosby; 2004;294.
3. Gross M, Nemcovsky C, Tabibian Y, Gazit E. The effect of three different recording materials on the reproducibility of condylar guidance registrations in three semi-adjustable articulators. J Oral Rehabil 1998;25:204-208
4. Salinas TJ, Treatment of edentulism: optimizing outcomes with tissue management and impression techniques. J Prosthodont 2009; 18(2):97-105.
5. Ratzmann A, Mundt T, Schwahn C, Langforth G, Hutzen D, Gedrange T, Kordass B. Comparative clinical investigation of horizontal condylar inclination using the JMA electronic recording system and a protrusive wax record for setting articulators. Int J Comput Dent 2007;10(3):265-284.
6. Silverman MM. Centric occlusion and fallacies of current concepts. J Prosthet Dent 1957; 7(6):750-769.
7. Gilboa I, Cardash HS, Kaffe I, Gross MD. Condylar guidance: Correlation between articular morphology and panoramic

radiographic images in dry human skulls. J Prosthet Dent 2008; 99(6):477-482.
8. Weinberg LA. An evaluation of basic articulators and their concepts part I and II. J Prosthet Dent 1963;13(6):645-663.
9. Nandini VV, Nair KC, Sudhakar MC, Poduval TS. Comparative evaluation of hight tracer, Chandra tracer, intraoral tracer, functiograph and checkbite. J Indian Prosthod Soc 2005; 5(1):26-32.
10. Boos RH. Centric relation and functional areas. J Prosthet Dent 1959;9(2):191-196.
11. Venkateshwaran R, Karthigeyan S, Manoharan PS, Konchada J, Ramaswamy M. A newer technique to program a semi adjustable articulator. J Pharm Bioallied Sci 2014;1:135-139.
12. Christensen LV, Slabbert JC. The concept of the sagittal condylar guidance: Biological fact or fallacy? J Oral Rehabil 1978;5(1):1-7.
13. Lee DI, Lee CH, Son MK, Chung CH, Kang DW. Comparison of condylar guidance using ARCUSdigma 2 and Checkbite. Journal of Korean Academy of Prosthodontics. 2013 Jul 1;51(3):153.
14. Donegan SJ, Christensen LV. Sagittal condylar guidance as determined by protrusion records and wear facets of teeth. Int J Prosthodont 1991; 4(5):469-472.
15. Stramotas S, Geenty JP, Petocz P, Darendeliler MA. Accuracy of linear and angular measurements on panoramic radiographs taken at various positions in vitro. Eur J Orthod 2002; 24 (1):43-52.
16. Gray RJ, Quayle AA, Horner K, Al-Gorashi AJ. The effects of positioning variations in transcranial radiographs of the temporomandibular joint: A laboratory study. Br J Oral Maxillofac Surg 1991;29(4):241-249.
17. Shreshta P, Jain V, Bhalla A, Pruthi G. A comparative study to measure the condylar guidance by the radiographic and clinical methods. J Adv Prosthodont 2012;4(3):153-157.
18. Brewka RE. Pantographic evaluation of cephalometric hinge axis. Am J Orthod 1981;79(1):1-9.
19. Thakur M, Jain V, Parkash H, Kumar P. A comparative evaluation of static and functional methods for recording centric relation and condylar guidance: A clinical study. J Indian Prosthodont Soc 2012; 12(3):175-178.