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## Clinical outcomes of different centric relation recording techniques in edentulous individuals: An observational cross-sectional study

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### Abstract

**Background:** For the rehabilitation of edentulous patients, the centric relation (CR), which is regarded as a repeatable and useable reference position, is the best maxillomandibular position.

**Objective:** We sought to evaluate the reproducibility of interocclusal wax and extra oral Gothic arch techniques for centric relation (CR) recording, as well as subjective evaluation of dentures made in this way for edentulous people.

**Methods:** In 18 patients with total denudation, centric relation and horizontal condylar guidance were detected utilising interocclusal wax and Gothic arch tracing. The articulator received these records, and the difference between the two values was noted. Following that, patients were split into two groups based on how the horizontal condylar guidance recording method and centric relation were used to create balanced occlusion. "Woelfel subjective evaluation criteria" were used to evaluate the dentures' response subjectively. Each technique's ability to be repeated was evaluated.

**Results:** In 22.41% of patients, the CR obtained using the static method (interocclusal wax record) was posterior to the CR obtained using the functional method (Gothic arch tracing), whereas in 70.92% of patients, the CR obtained using the static method was anterior to the CR obtained using the functional method, with the difference in CR varying between 0.5 and 1 mm. The clinical effectiveness of the entire denture is unaffected. According to subjective opinion, none of the measures in either group were statistically significant. By both techniques, the horizontal condylar guiding angle was roughly similar.

**Conclusion:** The dentures made using the two distinct approaches were comparable in terms of correctness of centric relation, retention and stability, condition of basal tissues as well as chewing effectiveness and level of patient satisfaction.

**Keywords:** Centric relation, complete denture, recording techniques, clinical outcome, reproducibility

### Introduction

Tooth loss over time leads to the morphological remodulation of all stomatognathic systems, particularly the condyle and its surrounding components [1]. In order to achieve muscle and joint balance, which will enhance performance, the patient's comfort, and the durability of the rehabilitation, it is essential to restore a stable jaw position during an edentulous patient's rehabilitation [2]. Patients with edentulous mouths lack the proprioceptive cues provided by their teeth to direct their mandibular motions. The temporomandibular joint receives proprioceptive signals from the sources in an edentulous patient. The rehabilitation of an edentulous patient requires a learnable, repeatable, and recordable maxilla to mandible relation that remains throughout life. The optimal maxillomandibular position for the rehabilitation of edentulous patients is the centric relation (CR), which is recognised as a reproducible and useful reference position [3]. Deflective occlusal contacts in a centric relationship can move the mandible away from the relationship or cause the denture bases and supporting tissues to move [4]. From a clinical and scientific perspective, it is crucial to have a method that can measure and record the location of the condyle in an exact and repeatable manner. Numerous strategies to create CR in edentulous persons have been described in the literature, with the physiological or guided graphic methods being the most common [5-8].

The centric jaw relation position is significant and essential because it acts as a guide for the development of occlusion in accordance with the overall stomatognathic system. Numerous centric relation (CR) registration strategies have been described in the literature [4, 9, 10]. They can be divided into one of four groups: (1) static; (2) graphic; (3) practical; and (4) cephalometric. Functional approaches have two subcategories: extra-oral and intra-oral. The Gothic arch tracings and the Inter-occlusal wax record (both static and functional) are the most widely used methods among them [4]. Hesse invented the first needlepoint tracing tool in 1897, and Gysi popularised it in 1910 [11] with the goal of identifying the CR in edentulous patients. The gothic arch technique offers greater repeatability outcomes than other techniques, according to the literature throughout time [12]. The trace of the gothic arch is a diagnostic technique for evaluating temporomandibular joint issues in addition to aiding in the recording of CR [13]. As a result, its repeatability can be a useful tool to determine whether a record is reliable [14]. The inclination of the condylar pathway is an important consideration when using prosthodontics to treat patients who are completely dentate. In order to build occlusion in accordance with the health and function of the stomatognathic system, we need to record condylar guidance values and modify the articulator condylar guidance [15].

Either extraoral or intraoral methods are used to collect the horizontal condylar guidance (HCG). Typical examples of extraoral approaches include the Gysi and McCollum procedures. Eight intraoral techniques exist: Plaster and carborundum grinding, teeth opposing wax chew-in, central-bearing point chew-in, needles' styli cutting compound rim, Messer man tracer modified needles' method, protrusive registration on softened compound, plaster 'check bites' and protrusive registration on softened wax are a few of the techniques used [16]. To capture the horizontal condylar guidance in routine practise, extraoral tracings or intraoral wax protrusive records during the try-in stage are advised [17]. To validate the CR and record the HCG, the graphic registering technique is suggested for treating patients without teeth [4].

Over time, the mandibular occlusal rim's central support point was used to stabilise it, concentrate its strength, and act as a trace to record the intraoral gothic arch (IOGA). As a result, several intraoral devices to record the gothic arch have been described in the literature. In order to create a physiological CR that is repeatedly repeated during swallowing, the deglutition procedure uses a physiological approach [18]. A variation of this procedure involves raising the tongue before closing the mouth. It is thought that the muscle activity involved in this movement causes the mandible to migrate into the CR position [19]. It is yet unknown if any of these techniques can successfully locate the CR site in people who lack teeth. Additionally, investigations on the repeatability of CR records using various methodologies have shown that certain professionals find it challenging to perform CR position records. A precise determination of CR is possible thanks to studies that have demonstrated various methods for concurrent analysis of the condylar housing position in the wall of the condylar guide in the semi-adjustable articulator in three axes (x, anteroposterior; y, superior-inferior; z, mediolateral) on the right and left sides [20].

This study was designed to evaluate and compare the variation in centric relation and HCG reported by the interocclusal wax record and the Gothic arch methods as well as to ascertain the calibre of the denture and the level of

patient satisfaction after denture implantation.

## Materials and Methods

### Study design

This *in-vivo* study was performed to compare the reproducibility of different methods of recording centric jaw relation from same edentulous patient. Eighteen edentulous patients who exhibited good health, average neuromuscular co-ordination, and relatively good ridges were selected at random from Prosthodontics department of Govt. Dental College & Hospital. Equal numbers of male and female patients were selected between age group of 50 to 60 years. The patients were informed about the study and their written informed consent was obtained before the commencement of this procedure.

### Inclusion criteria

Patients with well healed and rounded ridges having firm, resilient mucosa, class I jaw relation, with no pain/discomfort in any part of the stomatognathic system or any neuromuscular disorder like Parkinsonism, epilepsy or any disorder of the TMJ and who had no previous experience of complete dentures (CD) were selected.

### Experimental group design

The readings used for this study can be broadly divided into two categories. Readings for Group 1 were examined using a Spilt Cast mounting, and readings for Group 2 were evaluated using a Modified Ash Free Plane Articulator.

The entire dentures were made using traditional methods. To keep track of the jaw connection records, occlusal bite rims were created. For the other half of the patients, an extra set of bite rims was created. Mechanical and physiological techniques were combined to establish vertical jaw connections [4]. The maxillary cast was mounted on the semi-adjustable articulator (Hanau Wide Vue articulator, model 183) using a Hanau spring bow (Teledyne/Water Pik). Wax was used to attach the mandibular cast against the maxillary cast. Recording using Niswonger's technique for interocclusal CR [21].

Trial dentures were created, and during the try-in stage, using the interocclusal wax method, jaw relations were confirmed and HCG was measured at 6 mm of protrusion [4, 16]. To obtain a balanced occlusion, tooth setting was corrected for half of the cases (group I) and HCG were adjusted using the wax protrusive record. Another set of occlusal rims was at this point checked in the oral cavity and set aside after being modified on the articulator to attain the same vertical dimension.

Using the extraoral tracer affixed to occlusal rims formed of impression compound (DPI pinnacle), gothic arc tracing was obtained [4, 22]. To identify the central connection point on the smoked tracer plate, the tracing was mounted on the articulator. The tracing plate was now covered with a clear sheet, and the difference in the centric relation data captured by the two methods was measured. Quick-setting plaster was used between the mounting plates to create centric and protrusive plaster recordings at 6 mm protrusive movement.

All of the patients' horizontal condylar guiding was adjusted using the protrusive plaster record, and the mandibular cast was remounted utilising the Gothic centric relation. Wax-produced occlusal rims (group II) were introduced to replace those made with imprint compound. Trial dentures managed to achieve balanced occlusion.

Following processing, remounting, finishing, and polishing,

patients received their dentures. Using the Woelfel criterion, these dentures were subjectively assessed at several points following denture installation, including immediately after insertion, 48 hours later, one week later, one month later, and three months later [23].

An independent prosthodontist evaluated dentures for all parameters, including centric relation accuracy, retention of maxillary and mandibular dentures, stability of maxillary and mandibular dentures, and the health of the maxillary and

mandibular tissues. Maxillary and mandibular basal seat tissues were inspected for sore spots, with the location of the sore spots receiving special attention. Patients also assessed the entire dentures for retention, stability, and food-chewing ability. For the purpose of evaluating denture quality subjectively, Woelfel's [23] legend was used. The following is the rating legend provided by Woelfel for subjective evaluation:

**Table 1:** Subjective evaluation of denture quality rating legend given by Woelfel [23].

Score	Accuracy of centric relation	Retention (denture to soft tissue relationship)	Stability (denture to bone foundation relationship)	Condition of tissues
4	Centric relation and centric occlusion coincide	Extremely difficult to break border seal	Little or no movement on application of strong direct or rotatory force.	Tissues are firm and appear healthy with no signs of abrasion or other injury caused by the dentures
3	Slight variation (up to ½ mm) between centric and centric occlusion	Moderately difficult to break border seal	Little or no movement on application of rotatory force but is dislodged when a strong force is applied to one side	The tissues are generally firm and appear healthy except for small isolated regions
2	Variation (2/3–1.5 mm) between CR and CO	Slight resistance before border seal breaks	Considerable movement on application of rotatory force and is dislodged by a moderate direct force	Some movable tissue on the crest of ridge not previously present or irritated regions covering one-third of the denture bearing area
1	A gross error between CR and CO which can be corrected only by resetting the teeth	No border seal	A slight force either rotatory or direct causes the denture to move and become dislodged or both	Large general regions of redness involving half or more of the denture bearing surface or a considerable amount of movable tissue not present before or both

All abnormal areas are to be scribed on the drawings and the coded for redness (isolated), inflammation (general), hyperplastic tissue and ulceration. Grading frequency of patient's satisfaction with the dentures was evaluated subjectively by asking three question; i. Does your upper denture stay in place? ii. Does your lower denture stay in place? and iii. Can you chew your food well with your dentures? Responses were recorded as poor, fair, good and excellent.

**Results**

CR recorded by both the methods did coincide in 8.91% of

patients. CR recorded by static method (interocclusal wax record) was posterior to that recorded by functional method (Gothic arch tracing) in 22.41% of patients, while in 70.92% patients CR recorded by static method was anterior to that recorded by functional method with the variation in CR ranging between 0.5 and 1 mm.

Gothic arch tracings gave higher mean HCG values on both the sides as compared to protrusive wax record at try-in stage in all the subjects, although the difference was statistically insignificant ( $p>0.05$ ) (Table 2).

**Table 2:** Objective assessment of the variation in the horizontal condylar guidance values recorded by interocclusal wax and the Gothic arch method

Horizontal condylar guidance	Number of subjects	Mean of condylar guidance		Mean difference	SE	Probability (P)
		Gothic CG	Interocclusal wax CG			
Right	18	21.65° ± 6.07°	22.46° ± 5.12°	-0.93°	1.72°	0.67
Left	18	22.39° ± 6.13°	22.58° ± 6.49°	0.41°	1.67°	0.89

Subjective evaluation by the dentist as well as patient showed Complete dentures provided to patients in both the groups showed improvement in clinical performance with time. But

comparison for different parameters at different time interval was statistically insignificant [Tables 3 and 4].

**Table 3:** Subjective assessment of denture quality by the dentist

Parameter	Time interval	Group I (n = 9)				Group II (n = 9)				
		Grade	4	3	2	1	4	3	2	1
Accuracy of centric relation	Initial	7	2			8	1			
	After 48 h	8	1			8	1			
	After 1 week	8	1			9				
	After 1 month	9				9				
Retention	<b>Initial</b>									
	Maxillary	6	3			7	2			
	Mandibular	5	4			3	6			
	<b>After 48 h</b>									
	Maxillary	8	1			8	1			
	Mandibular	6	3			6	3			

	<b>After 1 week</b>								
	Maxillary	8	1			8	1		
	Mandibular	6	3			6	3		
	<b>After 1 month</b>								
	Maxillary	8	1			9			
	Mandibular	7	2			7	2		
	Stability	<b>Initial</b>							
		Maxillary	9				8	1	
		Mandibular	6	3			6	3	
		<b>After 48 h</b>							
Maxillary		9				8	1		
Mandibular		8	1			7	2		
<b>After 1 week</b>									
Maxillary		9				9			
Mandibular		7	2			8	1		
<b>After 1 month</b>									
Maxillary	9				8	1			
Mandibular	6	3			7	2			
Condition of tissue	<b>Initial</b>								
	Maxillary	8	2			5	4		
	Mandibular	4	5			6	3		
	<b>After 48 h</b>								
	Maxillary	8	1			6	3		
	Mandibular	3	6			4	5		
	<b>After 1 week</b>								
	Maxillary	9				6	3		
	Mandibular	6	3			7	2		
	<b>After 1 month</b>								
	Maxillary	9				7	2		
	Mandibular	8	1			7	2		

**Table 4:** Subjective assessment of patient satisfaction with dentures

Parameter	Time interval	Group I (n = 9)				Group II (n = 9)			
	Grade	4	3	2	1	4	3	2	1
Patient assessment of stability and retention of upper and lower denture	<b>Initial</b>								
	Maxillary	7	2			8	1		
	Mandibular	4	5			5	4		
	<b>After 48 h</b>								
	Maxillary	8	1			9			
	Mandibular	4	5			3	6		
	<b>After 1 week</b>								
	Maxillary	7	2			9			
	Mandibular	5	4			6	3		
	<b>After 1 month</b>								
Maxillary	8	1			9				
Mandibular	4	5			5	4			
Patient assessment of chewing ability of denture	Initial	2	5	2		4	5		
	After 484 h	1	4	4		6	3		
	After 1 week	2	3	4		4	5		
	After 1 month	5	4			7	2		

**Discussion**

When all of a person's teeth are lost, their ability to control their mandibular movements is compromised, and their mandibular postural position typically shifts forward. In order to properly treat these patients, we must first identify the most reproducible position of mandibular closure so that the centric relation, or occlusion of artificial teeth, can be adjusted to match it [4]. This outcome was in line with earlier research examining fewer approaches. For patients with inadequate muscle control, guided approaches are most frequently used by professionals.33 The operator's help with placement helps to lessen the possibility of muscular spasms happening to the patient in a stressful environment (such as a clinical setting) [24]. In the majority of cases, the centric relation reported by

the two methods varied by 0.5 to 0.1 mm, as was seen in the current investigation. Additionally, according to earlier research, gothic CR is more posterior than interocclusal CR recording techniques [25].

However, the variation was not statistically significant when dentists and patients evaluated the clinical performance of the dentures. This is explained by the ability of the musculature to adapt and the resilience of the basal tissues. According to Boucher, it is believed that at a shorter distance, the condyle would not move down its path a distance sufficient to be recorded on the instrument. Therefore, condylar guidance angles were recorded in this study at 6 mm of protrusive motions. Gothic tracings showed greater (10–35°) condylar guidance angles than the interocclusal wax approach (10–



30°).

According to Dawson, the majority of people have condylar inclinations of 25° or more<sup>[26]</sup>. The condylar guidance values determined by the two approaches differed by 0 to 5 degrees. According to information provided by<sup>[27]</sup>, a change of 5° in condylar guidance corresponds to a change of 0.25mm in the molar area. Instead of thinking in terms of degrees of angle, the sagittal condylar guidance should be viewed as steep, moderate, and slightly flat.

Patients accepted the dentures made using varied CR and HCG records with a similar level of comfort. This adaptability can be attributed to the ligaments' laxity and the flexibility of the muscles that regulate the mandibular movements and condylar route. It's important to keep in mind that neither the installation time for the graphic recording devices on the wax rollers nor the time for clinical training of the procedures were taken into consideration. These methods demand more mental and physical effort from both the practitioner and the patient. The study by Porwal *et al.* 63 did not find a significant correlation between CR records and potential compromise factors including age, sex, and the duration of Edentulism, therefore it is unreasonable to link these variables to the findings. But it's crucial that all the stomatognathic system's structures function in harmony, as was noticed and taken into account in this study.

### Conclusion

In terms of correctness of centric relation, retention and stability, condition of basal tissues as determined by the dentist, level of patient satisfaction, and chewing effectiveness, the dentures made using the two distinct approaches were comparable. It was discovered that the Gothic arch method's treatment was more technique-sensitive and demanded more time spent in the patient's chair as well as the dentist's. Additionally, there were more opportunities for errors to be introduced as a result of improper handling of the device and muscle and jaw fatigue brought on by constant effort to direct mandibular movements to create accurate arrow head tracing. The standard approach, on the other hand, was discovered to be more agreeable for both the operator and the patient.

### Conflict of Interest

Not available

### Financial Support

Not available

### References

1. Wedel A, Borrman H, Carlsson GE. Tooth wear and temporomandibular joint morphology in a skull material from the 17th century. *Swed Dent J.* 1998;22:85-95.
2. Bhojar PS, Godbole SR, Thombare RU, Pakhan AJ. Effect of complete Edentulism on masseter muscle thickness and changes after complete denture rehabilitation: An ultrasonographic study. *J Investig. Clin Dent.* 2012;3:45-50.
3. The glossary of prosthodontics terms: Ninth Edition. *J Prosthet Dent.* 2017;117:1-105. <https://doi.org/10.1016/j.prosdent.2016.12.001>
4. Zarb GA, Bolander CL, Hickey JC, Carlsson GE. Boucher's prosthodontics treatment for edentulous patients, 10<sup>th</sup> Edn. The C.V. Mosby Company, St. Louis; c1997. p. 283, 270, 422.
5. Wright WH. Use of intra-oral jaw relation wax records in

- complete denture prosthesis. *J Am Dent Assoc.* 1939;26:542-57.
6. Boos RH. Intermaxillary relation established by biting power. *J Am Dent Assoc.* 1940;27:1192-9.
7. Alvarez MC, Turbino ML, de Barros C, Pagnano VO, Bezzon OL. Comparative study of intermaxillary relationships of manual and swallowing methods. *Braz Dent J.* 2009;20:78-83.
8. Veloso L, Dias R, Messias A, Fonseca J, Nicolau P, de Medicina Dentária Á, *et al.* Evaluation of condylar position by CBCT after static and dynamic registration in edentulous patients. *Rev Port Estomatol Cir Maxilofac.* 2015;56:9-17.
9. Pyott JE, Schaeffer A. Simultaneous recording of centric occlusion and vertical dimension. *J Am Dent Assoc.* 1952;44:430-436.
10. Shanahan TEJ. Physiologic jaw relations and occlusion of complete dentures. *J Prosthet Dent.* 1955;5:319-324.
11. Kapur KK, Yurkstas AA. An evaluation of centric relation records obtained by various techniques. *J Prosthet Dent.* 1957;7:770-86.
12. de Moraes Melo Neto CL, da Silva EVF, de Sousa Ervolino IC, Dos Santos DM, de Magalhães Bertoz AP, Goiato MC. Comparison of different methods for obtaining centric relation: A systematic review. *Gen Dent.* 2021;69:31-6.
13. Seo RS, Murata H, Hong G, Vergani CE, Hamada T. Influence of thermal and mechanical stresses on the strength of intact and relined denture bases. *J Prosthet Dent.* 2006;96:59-67.
14. Keshvad A, Winstanley RB. An appraisal of the literature on centric relation. Part III. *J Oral Rehabil.* 2001;28:55-63.
15. Celenza FV. An analysis of articulators. *Dent Clin North Am.* 1979;23:305-326.
16. Swenson MG. Complete dentures, 4th Edn. The C.V. Mosby Company, St. Louis; c1959. p. 166, 167, 382-386.
17. Ecker GA, Goodacre CJ, Dykema RW. A comparison of condylar control Settings obtained from wax interocclusal records and simplified mandibular Motion Analyzers. *J Prosthet Dent.* 1984;51:404-406.
18. B Saunders; 1953. 30. Shanahan TE. Physiologic vertical dimension and centric relation. 1956. *J Prosthet Dent.* 2004;91:206-9.
19. Federick DR, Pameijer CH, Stallard RE. A correlation between force and distalization of the mandible in obtaining centric relation. *J Periodontol.* 1974;45:70-7.
20. Kulmer S. Die Kieferrelation im Wechselgebiss [Jaw relation in the mixed dentition]. *Osterr. Z Stomatol.* 1977;74:361-75.
21. Niswonger ME. The rest position of the mandible and the centric relation. *J Am Dent Assoc.* 1934;21:1572.
22. Rahn AO, Heartwell MC. Textbook of complete dentures. 5. USA: Lea & Febiger; c1993. p. 193-290.
23. Woelfel BJ, Paffenbarger GC, Sweeney WT. Clinical evaluation of complete dentures made of different types of denture. Base materials. *J Am Dent Assoc.* 1965;70:1170.
24. Dawson PE. New definition for relating occlusion to varying conditions of the temporomandibular joint. *J Prosthet Dent.* 1995;74:619-27.
25. Smith HF. A comparison of empirical centric relation records with location of terminal hinge axis and apex of the Gothic arch tracing. *J Prosthet Dent.* 1975;33:511-520.

26. Dawson PE. Evaluation, diagnosis and treatment of occlusal problems. 2. St. Louis: CV Mosby Company; c1989. p. 214.
27. Craddock FW. The accuracy and practical value of records of condyle path inclination. J Am Dent Assoc. 1949;38:697-710.