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**Dr. Sunitha Shammur**  
Professor, Department of  
Prosthodontics and Crown and  
Bridge, Bapuji Dental College  
and Hospital, Davangere,  
Karnataka, India

**Dr. Sasha Gracias**  
Intern, Bapuji Dental College  
and Hospital, Davangere,  
Karnataka, India

**Dr. Ruchira Paul**  
Postgraduate, Department of  
Prosthodontics and Crown and  
Bridge, Bapuji Dental College  
and Hospital, Davangere,  
Karnataka, India

**Dr. Nandeeshwar DB**  
Professor and Head, Department  
of Prosthodontics and Crown and  
Bridge, Bapuji Dental College  
and Hospital, Davangere,  
Karnataka, India

**Dr. Puja C Yavagal**  
Professor, Department of Public  
Health Dentistry, Bapuji Dental  
College and Hospital, Davangere,  
Karnataka, India

**Corresponding Author:**  
**Dr. Sunitha Shammur**  
Professor, Department of  
Prosthodontics and Crown and  
Bridge, Bapuji Dental College  
and Hospital, Davangere,  
Karnataka, India

## Comparison of wax ball centric registration technique with Gothic arch tracing: A clinical study

**Dr. Sunitha Shammur, Dr. Sasha Gracias, Dr. Ruchira Paul, Dr. Nandeeshwar DB and Dr. Puja C Yavagal**

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### Abstract

**Background:** Wax-ball centric relation technique is a novel, fast, dentist and patient friendly method of registration of centric position during establishment of jaw relation.

**Objective:** To compare Wax Ball centric registration technique with Gothic arch tracing and record the deviations in recording Wax Ball centric registration technique compared to Gothic arch tracing.

**Materials and Methods:** In a Clinical setting, comparative clinical Trial was conducted among a random sample of 20 elderly patients aged 30-60 years old, centric relation was recorded and compared using Wax Ball and Gothic arch tracing methods. The deviations observed with Wax ball technique compared to Gothic arch tracing method were recorded. Cohen's Kappa test was applied to test the level of agreement between the techniques.

**Results:** Out of the total 20 recordings of wax ball technique, 10 recordings showed deviations (Anterior -3, Posterior-7). The mean deviation was  $0.6 \pm 0.5$ mm (Range 0-2mm). Mean anterior deviation was  $1.16 \pm 0.7$ mm and mean posterior deviation was  $0.92 \pm 0.34$ mm. There was fair agreement between the two methods. (66.66%-agreement, Cohen's Kappa value=0.39).

**Conclusion:** Wax-ball centric relation technique could be a useful, fast and user-friendly method to record centric position.

**Keywords:** Centric relation, edentulous, efficacy, gothic arch tracing, wax ball

### 1. Introduction

Accurate recording of centric relation is an essential part of complete denture treatment. Errors in recording centric lead to a disturbance in the occlusion scheme and consequent TMJ and muscular problems [1]. Edentulous patients experience difficulty in centric closure due to a change in proprioception and subsequently adopt a new pattern of habitual closure. The procedure thus tends to be a long and tedious one when done using traditional methods [2]. The need of an easier technique to allow the patient to quickly assume the position and for the dentist to accurately record it in the minimum time needed has led to a search for new methods of obtaining centric relation [3]. Gothic arch tracing is most widely used method to record centric relation. However, major drawback of using graphic tracing record is its complexity in recording and also tracers are contraindicated in patients with flabby ridges/highly resorbed ridges, or patients with loss of neuromuscular coordination [4]. Recently a new method of recording of centric relation was introduced by Sushma *et al.* (2019) known as Wax ball technique which was compared with Dawson's bimanual technique [5]. Study demonstrated that wax ball technique was user friendly and cost-effective method of centric relation recording which could be suitably incorporated into conventional use. Literature search revealed no study exploring the applicability of wax ball technique. Hence, a comparative clinical study was planned with the objectives of comparing Wax ball centric registration technique with standard Gothic arch tracing method and to record the deviations in Wax Ball centric registration technique compared to Gothic arch tracing. The objective of the study was to test the null hypothesis that there was no difference in the recordings of centric relation done by using Gothic arch tracing and Wax ball techniques.

## 2. Materials and Methods

The study was conducted as a comparative clinical in-vivo single group trial, involving completely edentulous patients requiring complete dentures visiting clinics of Department of Prosthodontics of the college where study was conducted. Ethical clearance was obtained by the Institutional Ethical Review Board of the college before the start of the study. Informed voluntary written consent was obtained by the study participants. Consecutive sampling was employed and participants fulfilling the eligibility criteria were involved in the study. Patients falling under ASA Class 1 and 2, aged 30-60 years old with completely edentulous arches, first time denture wearers, requiring complete dentures and presenting Class I ridge relationship were included in the study. Patients with TMJ dysfunction neuromuscular problems and being treated to receive implant-supported full arch prostheses (removable or fixed) were not included in the study. Sample size was estimated to be 20, which was scientifically calculated using G\*Power 3.1, software, considering power of study at 0.8,  $\alpha$ error – 0.05, effect size – 0.6 (considering means of groups of previous study).

### 2.1 Method of Data Collection

Primary and final impressions were recorded and denture base and occlusion rims were fabricated on the master cast of participants of the study. They were called for tentative jaw relation record. Jaw relation was recorded by assessing

vertical dimension using Niswonger's technique. Facebook transfer was done and transferred to the semi adjustable articulator (*HANAU™ Wide-Vue* and *Artex®AP*). For each participant, centric relation position was recorded using Method 1(wax ball technique) and Method 2 (Gothic arch tracing method).

### 2.2 Procedure of wax Ball Method of recording Centric Relation<sup>[5]</sup>

After the establishment of orientation and vertical jaw relation, three wax orientation balls, 1 cm in diameter and 2 mm in thickness, were sealed to the upper record base of the first set of rims along the midline; one behind the incisive papilla, the second at the center of the palate, and the third immediately anterior to the posterior palatal seal region. (Figure 1). The record bases were then inserted into the mouth; the participants were instructed to relax, to open the mouth up to 20–25mm, and to put the tip of the tongue into the first (anterior most) orientation ball, then move it into the second, and finally to the third orientation ball. Holding the tongue on the third orientation ball, were instructed to close their mandible which would activate the elevator muscles to push the condyles into the fossa. (Figure 2) When the patient repeated this tentative centric relation position, the rims were sealed using the nick and notch method and records were mounted on the articulator.



**Fig 1:** Placement of wax balls on the maxillary denture base

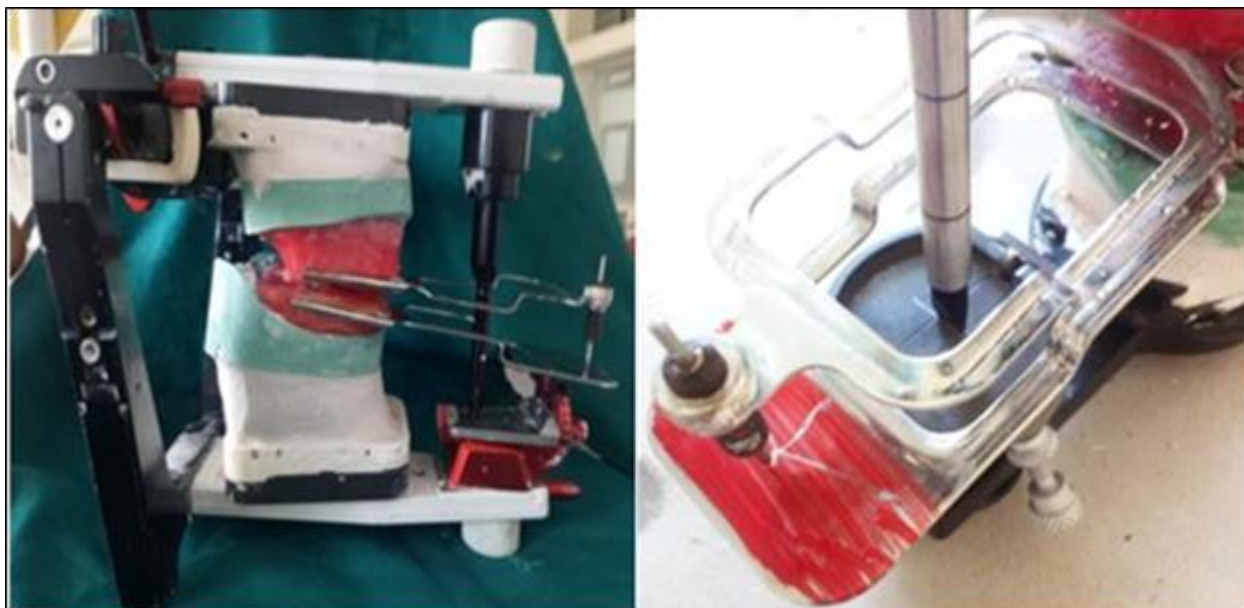


**Fig 2:** Centric record using the wax ball technique

**2.3 Procedure of Gothic arch tracing**

Two millimetres of wax was removed from the occlusal surface of the mandibular occlusal rim and the Gothic arch tracer was Attached to the maxillary and mandibular rims using the standard protocol. Protrusive, left lateral and right

lateral movements were recorded extra orally using the Gothic arch tracer and the position of centric relation was determined. (Figure 3). This position was checked to see if it coincided with the tentative centric relation obtained by Wax Ball technique.



**Fig 3:** Centric record using Gothic Arch Method

**2.4 Comparison of centric relation**

Total number of times the centric position obtained by the wax ball technique coincided with the Gothic arch tracing method was calculated and the deviations of the centric position recorded by the two methods was measured in millimetres. A total of 20 readings were compared and both anterior and posterior region deviations were recorded. All procedures were performed by a single investigator trained in both techniques.

**2.5 Statistical Analysis**

Statistical Package for the Social Sciences (SPSS), Version 20 (IBM Corp., Armonk, New York, USA) was used for data analyses. The significance level was fixed at  $P < 0.05$ .

Summary measures of deviations were calculated. Cohen’s Kappa test was applied to test the level of agreement between the two techniques.

**3. Results**

Table 1 shows deviations observed with recording of centric relation using wax ball technique compared to Gothic arch tracing. The mean deviation was  $0.6 \pm 0.5$  mm. Mean deviation in anterior region was more ( $1.16 \pm 0.7$  mm) compared to posterior region ( $0.92 \pm 0.34$  mm), (Table 2). Cohen Kappa statistics showed 66.6% agreement across the two techniques of recording with Kappa value of 0.399 denoting fair agreement between the methods (Table 3).

**Table 1:** Deviations observed with Wax Ball centric registration technique compared with Gothic arch tracing

Sr. No	Deviation in mm	Deviation Summary
1.	2	Mean- $0.6 \pm 0.5$ Median-0.25 Range-2 Minimum-0 Maximum-2
2.	0.5	
3.	1	
4.	0.5	
5.	0	
6.	1	
7.	1	
8.	1.5	
9.	0	
10.	0	
11.	1	
12.	0	
13.	0	
14.	0	
15.	1	
16.	0	
17.	0	
18.	0.5	
19.	0	
20.	0	

**Table 2:** Summary of deviation type, observed with Wax Ball centric registration technique compared with Gothic arch tracing

Type of Deviation	Number	Mean±SD	Median	Range
Anterior	3	1.16±0.7	1	1.5
Posterior	7	0.92±0.34	1	1

**Table 3:** Level of agreement between Gothic arch tracing and Wall ball centric registration

Number of observations in each group	Percent of agreement	Cohen's K	Interpretation
20	66.66	0.399	Fair agreement

#### 4. Discussion

The goal of keeping centric relation records is to build guidelines as a starting point for developing occlusion with prosthetic teeth that is in sync with various masticatory apparatus structures, including the TMJ. It helps tissues retain their physiologic and anatomic health. When maximum intercuspation corresponds with centric position, the prosthesis is stabilized, and the health of the remaining associated tissues is preserved. Centric relation records can be grouped into four categories- direct check bite (interocclusal) recordings, graphic recordings (intra-oral and extra-oral), functional recordings, and cephalometrics [6]. Check bite records are commonly used to register centric relationships. The maxillary and mandibular casts are held in place, and the relationship will be transferred to the. Mandible moves in three dimensions in space and makes static records at specific locations. Interocclusal recordings have the drawback of providing correct relationships between castings only at the jaw positions where they are created. The movements between the recorded positions must be interpolated by the articulator. Because the jaw's border movements are usually curved, an articulator programmed with solely interocclusal records is likely to be limited. These curved boundaries can be captured graphically, and an articulator capable of curved movements can be designed to accept these recordings, resulting in a more exact replication of jaw movements [7]. Intraoral Gothic arch (needle-point) tracing is the most used method of registering centric relation. Intraoral tracers have the advantage that the bearing-tracing device is sturdy enough to withstand biting pressures and can be locked in place with a locking disc [6]. However, disadvantage is that, during the tracing, the intraoral tracings are not visible. Because the intraoral tracings are small, finding the real apex is difficult. To ensure precision, the tracer must remain at the apex while injecting plaster between the occlusion rims. If the patient moves the rims before they are secured, the recordings will shift on their basal seat, making the accuracy suspect [6]. Advantage of extra oral tracings are; they are located further from the centres of rotation, the tracing point is usually much larger than its intraoral cousin, and the apex is more apparent. During the tracings, the extra oral tracings are apparent. As a result, the patient can be directed and guided during mandibular motions. During the process of injecting plaster between the occlusion rims, the stylus may be seen in the apex of the tracing [6]. Criticism of Gothic arch tracing stated that equalization of pressure did not occur, in prognathic or retro gnathic patients it could not be used, and flabby tissues or large tongues could cause shift in base. Main disadvantage of Gothic arch tracing is that the pressure equalization does not occur, and technique cannot be utilized in prognathic or retro gnathic patients, and flabby tissues or wide tongues could cause a change in the base tracing [8]. A study

concluded that, Gothic arch method was technique sensitive and required more chair-side time for both the dentist and the patient. Furthermore, there were more risks of faults being incorporated due to device mistreatment and, muscular and jaw fatigue from repeated efforts to steer the mandibular movement's [2]. It is clear from dental literature that, with so many differing viewpoints and so much ambiguity around centric relation records, a specific technique may be required for a unique case or a difficult patient [9]. In the end, the dentist's ability and the patient's cooperation are perhaps the most critical aspects in ensuring an accurate Centric Relation record. With this background, the authors tried new technique of registering centric relation called Wax Ball technique introduced by Sushma *et al.* (2019) [5] and compared it with standard Gothic arch tracing method. Results indicated fair agreement of wax ball recordings with Gothic arch tracing method. The results could not be compared with other studies since it's the first study to compare this new technique with Gothic arch tracing. However, study done by Sushma *et al.* concluded that wax ball technique required less time for centric registration compared to Dawson's bimanual technique, since it could be readily taught to the patient and demonstrated by holding the record base in one hand and demonstrating where the tongue must touch the record base when the instructions were given to do so The orientation wax balls on the record base clearly provided a guide or orientation space in the mouth for the patients to touch the tongue tip and continue pulling the condyles into the fossa with the elevator muscles [5]. Within the study's constraints, it can be concluded that the wax ball orientation technique for recording Centric relation is simple to comprehend and use and is comparable to standard Gothic arch tracing method. It may serve as an easy method for training undergraduate dental students to register centric relation. It is also cost-effective and requires minimal armamentarium, and the centric relation is reproducible and accurate, allowing it to be used in clinical practice on a daily basis. However, further studies should be conducted to test and compare the efficacy of this new technique with standard methods of registering centric relation.

#### 5. Conclusion

The Wax Ball method of centric relation recording is comparable to Gothic Arch tracing method and may serve as a useful, fast and user-friendly method to record centric position.

#### 6. Acknowledgement

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#### 7. Conflict of interest

Authors declare no conflict of interest

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