

# A clinical comparative study to assess the efficacy of a new centric registration technique with a conventional technique

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## Abstract

**Aim:** The aim and objectives of this study were to assess and compare the efficacy of a new copyrighted technique (wax ball technique, L-77997/2018) and design (denture base design for the wax ball technique, L-78006/2018) for recording centric relation (CR).

**Settings and Designs:** *In vivo* – comparative study.

**Materials and Methods:** This study was conducted on sixty consented edentulous patients. The study participants were divided into Group I and Group II. CR in Group I patients was recorded using Dawson's bimanual technique (technique 1). For participants in Group II, CR was recorded using the authors' copyrighted technique (technique 2). Time taken and accuracy of CR records by both the techniques were evaluated.

**Statistical Analysis Used:** Descriptive statistics such as frequency and percentage were calculated for categorical variables, mean and standard deviation were calculated for quantitative variables. Independent *t*-test was used to compare the time taken to record the CR between the two groups. The accuracy of both the techniques was assessed by Mann–Whitney U-test.

**Results:** The mean time taken for technique 1 was 56.47 s, whereas for technique 2, it was 5.97 s, with an overall mean difference of 50.5 s between the two techniques. Both techniques were found to be accurate, as the CR recorded during jaw relation matched with CR during trial in all the cases in both the groups (frequency 30 (N) and cumulative percentage 100%).

**Conclusion:** From the study, it was found that, time taken for technique 2 was statistically less compared to that of technique 1, and both the techniques were found to be equally accurate.

**Keywords:** Accuracy, centric relation, edentulous, efficacy, retruded

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## INTRODUCTION


The definition of centric relation (CR) has been a point of contention for over a century, with a myriad of conflicting definitions being proposed.<sup>1,2</sup> Research in this field has

centered around the position of the head of the condyle in the glenoid fossa during CR position, but still it remains controversial.<sup>3-14</sup> Patients usually require preconditioning prior to fabrication of new dentures so as to adapt to correct

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centric.<sup>[15,16]</sup> There exist various techniques for recording CR.<sup>[1-6,10-16]</sup> In this article, the authors intend to introduce and compare a new technique and method for registering CR with Dawson's bimanual technique and assess its efficacy.

## MATERIALS AND METHODS

The study was conducted as a randomized controlled trial on patients who were to be rehabilitated using solely tissue-borne prosthesis. Completely edentulous patients having Class I ridge relationship, without any temporomandibular joint disorders, and having good neuromuscular control were included in the study. Patients who were treated to replace an existing tissue-borne removable prosthesis (complete or removable) were excluded from the study. Those patients who were being treated to receive implant-supported, full-arch prosthesis, removable or fixed, were excluded from the study. Patients with poor neuromuscular control and those requiring maxillofacial prosthesis were also excluded from the study.

Ethical clearance was obtained from the institutional protocol committee and the university's ethical committee (ref no KIMSSDU/IEC/04/2016). The participants had the protocols explained in their own mother tongue. Informed consent was obtained from all the study participants.

The sample size for the study was determined by convenient sampling technique which numbered up to 60. A total of 119 completely edentulous patients were invited to participate in the present study. Of the 119 patients, 60 eligible, consented participants were recruited for the study.

The participants were randomized in a 1:1 ratio into the following two groups by picking lots.

- Group I ( $n = 30$ ) – Participants were guided into CR using technique 1
- Group II ( $n = 30$ ) – Participants were guided into CR using technique 2.

Analogs for the denture-bearing areas in the upper and lower arches according to the standard operating protocols of the teaching curriculum at the dental school for both groups were fabricated, and the occlusal rims were constructed using standard protocols. Orientation and vertical jaw relations (JRs) were recorded using standard techniques.

At the time of recording CR, participants in Group I were guided into CR using technique 1. Participants in Group II were guided into CR following the method detailed below (technique 2).

After the establishment of orientation and vertical JR, three orientation balls, 1 cm in diameter and 2 mm in thickness, were sealed to the upper record base 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 shows the modified denture base design, and Figure 2 shows the modified denture base design in patient's mouth.

Participants were shown the record bases and given instructions pertaining to the sequence and position where they must place their tongue during the procedure. The record bases were then inserted into the mouth; the participants were instructed to relax, to open the mouth at 20–25 mm, and to put the tip of the tongue into the first (anterior most) orientation ball [Figure 3], then move it into the second [Figure 4], and finally to the third orientation ball [Figure 5]. Holding the tongue on the third orientation ball, they were instructed to close their mandible which would activate the elevator muscles to push the condyles into the fossa [Figure 6]. When the patient could repeat the CR position, the rims were sealed using the nick and notch method.

The time taken to record and establish CR was recorded using a digital timer (Frontier Euro Digital Timer Programmable Controller, TM-619 -2-H) (Taiwan). For technique 1, time was recorded from the start of guiding the mandible into CR until the wax occlusal rims were sealed. For technique 2, recordings were made from the time that the patient placed his/her tongue on the first orientation wax ball to the time that the wax occlusion rims were sealed.

All procedures were performed by a single operator trained in both techniques.

Data were entered and analyzed using SPSS software v23.0 (IBM SPSS Statistics for Windows, Version 23.0. Armonk,



**Figure 1:** The denture base design



**Figure 2:** The denture base in the patient's mouth



**Figure 3:** Patient's tongue tip touching the first orientation wax ball



**Figure 4:** Patient's tongue tip touching the second orientation wax ball



**Figure 5:** Patient's tongue tip touching the third orientation wax ball

New York). Descriptive statistics such as frequency and percentage were calculated for categorical variables, and mean and standard deviation were calculated for quantitative variables. Gender distribution and age distribution among the two groups were tested by Chi-square test and sample *t*-test, respectively. Independent *t*-test was used to compare the time taken to record CR between the two techniques. Accuracy of both the techniques was assessed by whether or not the CR recorded during the JR matched with the CR during the trial of the dentures by applying Mann–Whitney U-test.

## RESULTS

From an initial pool of 119 potential participants, 51 participants were not eligible due to unsatisfactory criteria which included patients who were being treated to receive implant-supported, full-arch prosthesis, patients with poor neuromuscular control, and those requiring maxillofacial prosthesis. From the remaining 68 patients, 60 consented study participants were recruited for the study that fulfilled the inclusion criteria for the study.

**Table 1: Frequency distribution of gender among the two groups**

Group	Gender		$\chi^2$ (df)	<i>P</i>
	Frequency (%)			
Technique 1			0.278 (1)	0.587
Male	19 (63.30)			
Female	11 (36.7)			
Total	30 (100.0)			
Technique 2				
Male	17 (56.7)			
Female	13 (43.3)			
Total	30 (100.0)			

Table 1 shows the frequency distribution of gender among the two groups. There were 30 patients in both the groups; for technique 1, 19 males (63.3%) and 11 females (36.7%), whereas for technique 2, there were 17 males (56.7%) and 13 females (43.3%). Using the Chi-square test, it was found that *P* = 0.587, which shows that there was no statistically significant difference among the two groups regarding gender.

Table 2 summarizes the age statistics among the two groups. The mean age of patients under technique 1 was  $58.33 \pm 11.874$  years, whereas that of technique 2

was  $61.17 \pm 12.157$  years. Applying independent sample *t*-test ( $P = 0.264$ ), there was no statistical difference among the mean age between the two groups.

Graph 1 depicts the time taken to register CR by both the techniques. Time taken by technique 1 was 56.47 s, whereas the time taken by technique 2 was 5.97 s.

Table 3 summarizes the comparison of time taken for CR among the two groups by independent sample *t*-test. The mean time taken for technique 1 was  $56.47 \pm 75.368$  s, whereas for technique 2, it was  $5.97 \pm 2.042$  s, with a mean difference of 50.500 s, which was found to be statistically significant with  $P = 0.001$  ( $t = 3.669$ ;  $df = 58$ ) and confidence interval = 22.349–78.054.

Table 4 summarizes the data of technique 1 and technique 2 where the accuracy of the CR registered by both the techniques was verified during the try in appointment. There was no statistical difference for accuracy among the two groups with  $P = 1.000$ . The CR recorded during JR matched with the CR during trial (try in stage) in all the cases in both the groups. Hence, both the techniques were found to be accurate using Mann–Whitney U-test.

## DISCUSSION

The definition of CR has changed over time,<sup>[2]</sup> so has the type of materials used for registering the CR<sup>[17,18]</sup> using various techniques.<sup>[19]</sup> From the postero–superior relation of the condyle in relation to the articular fossa to the

antero–superior relation of the condyle to the articular fossa, the CR definition has traveled with time<sup>[2]</sup> to even Celenza<sup>[20]</sup> concluding that there are many CR positions, with Shafagh *et al.*<sup>[21]</sup> stating the diurnal variation of CR position. Kandasamy *et al.*<sup>[22]</sup> even questioned the very existence of CR position whether it was right to give the CR position so much of importance.

Wood and Elliott<sup>[5]</sup> stated that Roth's technique of CR registration was the most accurate. Galeković *et al.*<sup>[23]</sup> studied the reproducibility of three CR registration techniques, namely bimanual manipulation, chin point guidance, and Roth's method by means of condyle position analysis. In conclusion, they stated that all the three methods were reliable and could be performed in day-to-day clinical practice. Swenson *et al.*<sup>[3]</sup> recorded CR using five different techniques such as tongue tip to soft palate, chin point guidance, leaf gauge, bimanual manipulation, and Roth Power Bite, at five different time points and concluded that all the five techniques were highly repeatable with very small range of variations. Paixão *et al.*<sup>[24]</sup> investigated the reproducibility of Dawson's bilateral manipulation and Gysi's Gothic arch tracing CR registration techniques in healthy individuals who presented Angle's Class I occlusion. They found that the Gysi's Gothic arch tracing was more accurate compared to the bilateral manipulation. Alvarez *et al.*<sup>[25]</sup> compared the CR record using an anterior jig with chin point guidance, swallowing, and bimanual manipulation and concluded that among the three methods evaluated, the swallowing method is extremely patient dependent and further there was no statistically significant difference between the bimanual manipulation and the chin point guidance method in terms of reproducibility. Keshvad and Winstanley<sup>[26]</sup> conducted a study to determine the most repeatable CR positions using three different CR registration techniques. The techniques used were bimanual manipulation with a jig, chin point guidance with a jig, and the Gothic arch tracing methods and concluded that the Gothic arch tracing was the least, whereas the bimanual manipulation was the most consistent method.

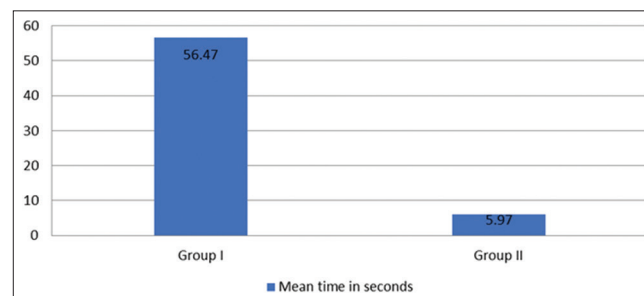
**Table 2: Age statistics among the two groups**

Group	n	Mean±SD	Independent sample t-test (P)
Age			
Technique 1	30	58.33±11.874	0.264
Technique 2	30	61.83±12.157	

SD: Standard deviation



**Figure 6:** Upper and lower occlusal rims closed in centric relation



**Graph 1:** Time taken to register centric relation (S)

**Table 3: Comparison of time taken for centric relation among the two groups by independent t-test**

Group	n	Mean±SD	SEM	t (df)	Mean difference	P (independent t-test)	CI
Time taken							
Technique 1	30	56.47±75.368	13.760	3.669 (58)	50.500	0.001	22.349-78.054
Technique 2	30	5.97±2.042	0.373				

SD: Standard deviation, SEM: Standard error mean, CI: Confidence interval

**Table 4: The frequency and percentage of accuracy for the two techniques**

Groups	Accuracy calculation using Mann-Whitney U-test				
	CR during JR coincided with CR during trial	Frequency (%)	Valid (%)	Cumulative (%)	P
Technique 1	Yes	30 (100.0)	100.0	100.0	1.000
Technique 2	Yes	30 (100.0)	100.0	100.0	

CR: Centric relation, JR: Jaw relation

The literature search reveals that the clinicians and researchers have compared various materials and methods to register an accurate CR,<sup>[10,12,27]</sup> and it was found that the tongue can be used to guide the mandible to CR.<sup>[10,12,13]</sup> However, the most conclusive statement turns out to be that irrespective of the methods used, patient's compliance and practitioner's knowledge and expertise are the two most important factors to achieve the CR position.

A recent study was conducted by Wiens *et al.*<sup>[28]</sup> to assess the agreement or disagreement of various definitions of CR among the members of academics. As a result of the survey, the authors concluded that a major agreement for CR was that CR is a spatial relationship, is repeatable, is physiological, and is independent of tooth contact position. Duggal *et al.*<sup>[29]</sup> in their review stated that CR should be recorded with the least possible error and the interocclusal material used for recording CR plays an important role in accuracy. Jilani *et al.*<sup>[30]</sup> introduced a new method of recording CR with the use of modeling wax reinforced with Aluwax™. The authors claim that their technique is simple, is easy to master, and requires less armamentarium. Lin and Wagner<sup>[31]</sup> described an efficient and a feasible technique to construct an intraoral central bearing tracing device which can be used to make CR records, to determine vertical dimension of occlusion, and to detect occlusal interferences. Ćimić *et al.*<sup>[32]</sup> compared the reproducibility of CR records fabricated with chin point guidance with jig in patients with disc displacement with reduction and healthy individuals and found that there was no difference in the reproducibility of CR records. With the fact that fabricating a conventional complete denture requires several clinical appointments and laboratory procedures, Infante *et al.*<sup>[33]</sup> presented a case of complete denture fabrication using computer-aided design/computer-aided manufacturing technology eliminating the use of casts, flasking, and processing techniques. The authors emphasized on the fact that the difficulties during recording of maxillomandibular

relationships are completely eliminated. With the above discussion, it can be safely said that the recent emphasis has been on the fact that CR recording should be easy, should not be time consuming, and should be repeatable and accurate.

With this context in mind, the authors have presented a technique to register the CR which is time saving and easier to understand by clinicians and patients as well. This newly designed technique was compared with the Dawson's bimanual method. From the study, it was found that the time consumption was statistically less compared to the Dawson's bimanual technique; however, both the techniques were found to be equally accurate. In authors' opinion, less time is required for CR registration using the new technique because this technique can be easily explained to the patient as well as can be demonstrated by holding the record base in the hand and showing where the tongue has to touch the record base when the instructions are given to do so. The orientation wax balls on the record base clearly give a guide or orientation space in the mouth for the patients to touch the tongue tip and proceed further in letting the elevator muscles pull the condyles into the fossa.

## CONCLUSION

Within the limitations of the study, it can be concluded that the wax ball orientation technique to record CR is easy to understand and execute. It is also cost-effective and requires minimum armamentarium, and also the CR is repeatable and accurate, and hence can be adopted in the day-to-day clinical practice.

## Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent forms. In the form the patient(s) has/have given his/her/their consent for his/her/their images and other clinical information to be reported in the journal. The patients understand that their names and initials will

not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

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Nil.

### Conflicts of interest

There are no conflicts of interest.

### Copyright information

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