

Centric relation registration: intra- and interexaminer agreement after a calibration program

Avaliação da reprodutibilidade intra e interexaminador no registro da relação cêntrica, após um programa de calibração

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ABSTRACT: Centric relation (CR) has been considered a maxillomandibular position of choice for some dental and prosthetic procedures. Although regarded as a fully reproducible relation, there is great controversy about its clinical use and recording technique, especially in patients with signs and symptoms of temporomandibular disorders (TMD). This study aimed at evaluating the effectiveness of a training program on intra- and interexaminer agreement when determining the clinical record of the CR position. Forty individuals constituted the sample, divided into symptomatic (TMD) and asymptomatic groups. Three previously calibrated examiners performed the initial assessment and the second evaluation after 30 days in a blind design, using Dawson's bilateral manipulation technique with and without an anterior stop. The amount of frontal and sagittal deviations in relation to intercuspal position, the presence of pain and discomfort during manipulation, and the first occlusal contact in CR were analyzed. Kendall and Kappa tests with a 5% level of significance were used to determine agreement. Values for both intra- and interexaminer agreement were deemed good. The best results were obtained for frontal deviations and assessment of pain (or absence of it) during manipulation. Sagittal deviations showed the lowest agreement in both examinations. The authors concluded that a calibration program could be effective for intra- and interexaminer agreement when recording centric relation. However, caution is recommended when analyzing some isolated items.

DESCRIPTORS: Centric relation; Temporomandibular joint disorders.

RESUMO: Na tentativa de estabelecer uma posição maxilomandibular reprodutível em pacientes sem dentes suportes posteriores ou portadores de oclusão instável, o conceito de relação cêntrica (RC) foi introduzido. Apesar de ser utilizada como uma posição de referência, existe uma considerável divergência de opiniões sobre a sua reprodutibilidade. Este estudo procurou avaliar se os métodos de treinamento profissional são efetivos na análise e obtenção de RC. Para isso utilizou-se uma amostra de 40 indivíduos, divididos em 20 assintomáticos e 20 portadores de disfunções da ATM. Os indivíduos foram avaliados por 3 examinadores, previamente calibrados. Foram realizados 2 exames: inicial e final (30 dias após o inicial), possibilitando dessa forma, análise da concordância interexaminadores, assim como intra-examinadores. Posteriormente, os resultados foram submetidos à análise estatística, utilizando-se os testes de concordância de Kendall e de Kappa. Os resultados foram considerados bons, sendo os melhores obtidos para a análise do desvio frontal e relato de dor (ou ausência) durante a manipulação. Os autores concluíram que os programas de calibração podem ser efetivos para análise da RC. No entanto, cautela é recomendada quando da análise de alguns itens isolados.

DESCRITORES: Relação central; Transtornos da articulação temporomandibular.

INTRODUCTION

The concept of centric relation (CR) was introduced in dentistry with a view to reproduce the mandibular position during the fabrication of dentures, therefore providing conditions for complete

dentures to develop all their functions in harmony with the other components of the stomatognathic system.

One of the first reports on CR was made by Gysi⁸, in 1910, who presented the gothic arch tracing technique for achieving this position, initia-

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ting a new phase in dentistry. After this study, different concepts have appeared about this occlusal relationship, which were altered according to opinions from that time period. The current concept of CR most accepted by the scientific community was provided by the 7th edition of the "Glossary of Prosthetic Terms" (1999), as follows: "the maxillo-mandibular relationship in which the condyles articulate with the medial portion of their respective disks, being this complex (disk-condyle) in an antero-superior position against the surface of the articular eminence". When employed for prosthetic reconstructions, this is a suitable position because of its reproducibility⁴. One review of the reproduction techniques reveals that most of them (including the bilateral manipulation, the chin point guidance, the Lucia jig or the laminated calibrator) are able to achieve a consistent condylar position in nearly all patients. Yet, some studies^{5,10} have demonstrated that the precision of most of these techniques is severely limited in the presence of temporomandibular disorders.

Several studies addressing the reproducibility of CR have related small variations in the condylar position between several CR recordings^{15,16,21,22}. Despite of its reproducibility, there is a millimetric variation, i.e. an accurate achievement of CR recording is not always feasible^{12,13,23}.

Some evidence suggests that the CR position may vary with time and with the different recording methods. Moreover, several factors may influence its registration, such as emotional stress, TMJ and facial muscle pain, neuromuscular conditioning, manipulation technique or operator's guidance². On this basis, the need to evaluate the efficacy of a calibration procedure for CR analysis is highlighted.

The present study aimed at evaluating the intra- and interexaminer agreement in the analysis of CR position, comparing these findings in asymptomatic individuals and patients with TMJ internal derangements.

MATERIAL AND METHODS

The present study comprised a sample of 40 individuals, divided into 2 groups (asymptomatic and symptomatic patients). Group I (asymptomatic) included 20 individuals equally distributed between genders, which were randomly selected from the dental clinics, School of Dentistry of Bau-

ru (FOB/USP). These patients presented no signs and symptoms of TMD.

Group II (symptomatic) consisted of 20 individuals equally distributed between genders presenting with signs and symptoms of arthrogenic TMD. All these patients were randomly selected from the individuals attending the TMD and Orofacial Pain Center, Department of Prosthodontics (FOB/USP). Inclusion criteria for this group was accomplished after anamnesis and detailed physical examination, comprising muscle and TMJ palpation, evaluation of the mandibular movement and inspection of joint sounds.

The individuals received information on the objectives of the research, and, after all procedures had been fully explained, they signed an informed consent term, in agreement with Regulation #196/96 of the Brazilian National Health Council.

The examiners were trained to perform the manipulation technique and the CR recording method. For that purpose, the research coordinator demonstrated the technique and subsequently the three examiners carried out the same procedure in four dental students, simulating the study evaluation.

The bilateral manipulation technique suggested by Dawson was selected, with or without an anterior stop.

Manipulation of the patients was initially performed with no anterior stop. During manipulation, the examiners identified the first centric dental contact, by means of an articulating paper (AccuFilm II, USA). Vertical and sagittal deviations were also recorded in a standardized form, as well as the report of pain or discomfort upon manipulation. Afterwards, a cotton roll was placed between the incisors for 5 minutes to act as a stop, in order to eliminate occlusal contact and mechanoreception of the periodontal ligament. After this period, the same procedures were repeated in an attempt to verify the influence of the stop on the CR recording.

The groups of 10 patients evaluated in each session always comprised 5 asymptomatic and 5 symptomatic individuals, who were randomly evaluated. Yet, examiners were blinded to group distribution.

The study variables were described as percentages. The Kendall test of concordance evaluated interexaminer agreement, whereas intraexaminer agreement was analyzed through the Cohen's Kappa test. A significance level of 5% was selected for

both. The Kappa (K) and Kendall (W) values are interpreted as follows: from 0 to 0.20 - poor agreement; from 0.21 to 0.40 - regular; from 0.41 to 0.60 - moderate; from 0.61 to 0.80 - satisfactory; and from 0.81 to 1.00 - excellent.

RESULTS

Tables 1 and 2 demonstrate the results of interexaminer agreement of the 1st and 2nd evaluations for the different study variables, according to the Kendall test.

DISCUSSION

The literature on interexaminer agreement for the clinical evaluation of CR reproducibility is quite large. Previous studies^{3,6,7,24} have focused on the interexaminer agreement for evaluation of caries, signs and symptoms of periodontal disease and radiographic examinations. All these studies have employed relatively objective data, such as pocket probing depth, bone loss and presence or absence of caries, whereas standardization of CR manipulation is based on less objective data.

TABLE 1 - Agreement value (W) for the study variables between the different examiners (interexaminer analysis), with no distinction of group (symptomatic or asymptomatic) – 1st and 2nd evaluation (Kendall test).

Evaluated item	1 st evaluation		2 nd evaluation	
	W	p	W	p
Orthodontic class	0.69	< 0.001	0.60	= 0.001
Frontal deviation (WOAS)	0.73	< 0.001	0.70	< 0.001
Sagittal deviation (WOAS)	0.50	= 0.027	0.62	= 0.001
Report of pain during manipulation (WOAS)	0.87	< 0.001	0.78	< 0.001
1 st contact (WOAS)	0.72	< 0.001	0.74	< 0.001
Frontal deviation (WAS)	0.63	= 0.001	0.73	< 0.001
Sagittal deviation (WAS)	0.53	= 0.013	0.66	< 0.001
Report of pain during manipulation (WAS)	0.88	< 0.001	0.90	< 0.001
1 st contact (WAS)	0.66	< 0.001	0.83	< 0.001

WOAS: without anterior stop; WAS: with anterior stop.

TABLE 2 - Agreement value (W) for the study variables between the different examiners (interexaminer analysis), with distinction between symptomatic (I) and asymptomatic (II) groups.

Evaluated item	Group I		Group II	
	W (I)	p (I)	W (II)	p (II)
Orthodontic class	0.81	0.001	0.53	0.056
Frontal deviation (WOAS)	0.73	0.002	0.71	0.005
Sagittal deviation (WOAS)	0.36	0.372	0.61	0.019
Report of pain during manipulation (WOAS)	0.74	0.002	0.81	< 0.001
1 st contact (WOAS)	0.66	0.008	0.81	< 0.001
Frontal deviation (WAS)	0.70	0.004	0.57	0.036
Sagittal deviation (WAS)	0.39	0.267	0.63	0.015
Report of pain during manipulation (WAS)	0.33	0.456	0.85	< 0.001
1 st contact (WAS)	0.71	0.004	0.57	0.032

WOAS: without anterior stop; WAS: with anterior stop.

The literature unanimously states that standardizing the examination is paramount to assure reliability of the information obtained.

The interexaminer evaluations performed in the present study demonstrated a satisfactory agreement for most study variables: 0.645 (orthodontic class), 0.715 (frontal deviation without anterior stop - FDWOAS), 0.730 (contact WOAS), 0.68 (frontal deviation with anterior stop - FDWAS), 0.745 (contact WAS). Results were excellent for the items report of pain WOAS (0.825) and report of pain WAS (0.890), therefore demonstrating the importance of calibration procedures before examiners initiate the evaluations.

The statistical outcomes in Table 1 (1st and 2nd interexaminer evaluations) revealed that the sagittal deviations without anterior stop (SDWOAS) and sagittal deviation with anterior stop (SDWAS) demonstrated the lowest agreement levels (0.50 and 0.53 at the 1st evaluation, and 0.62 and 0.66 at the 2nd evaluation, respectively). A small percentage of individuals presented coincident CR and intercuspal (IC) positions^{1,17}. A much higher percentage of individuals have a difference of 0.1 to 1.5 mm between CR and IC. The discrepancy between both positions, commonly named centric slide or centric discrepancy, may occur in all three planes of the space and is estimated to be 0.1 to 1.5 mm in the vertical direction, 0.1 to 1.0 mm in the horizontal direction and smaller than 1.0 mm in the transverse direction. This small variability of sagittal displacement observed in the literature, combined to the difficulty experienced by examiners upon measuring, has influenced the agreement levels. The difficulty to evaluate the discrepancy is transmitted to the judgment form itself, in which differences below 0.5 mm may yield disagreement between examiners (IC = CR; up to 1.0 mm; and higher than 1.0 mm)¹⁷.

In the present study, the report of possible pain during manipulation in symptomatic patients demonstrated an optimal agreement, possibly due to the fact that most patients in this group had a complaint of pain during manipulation, thus simplifying analysis of this item by the examiners and therefore increasing the agreement level. According to Harper, Schneiderman⁹ (1996), the determination of the condylar hinge axis with the condyle in CR was more reproducible in patients with TMJ internal derangement than in asymptomatic patients. This might be the outcome of the anatomic obstruction of a displaced disk without reduction

or the presence of adherences of TMJ, limiting the condylar position during the translation phase. The present study, however, did not evaluate disc displacement without reduction patients.

Regarding the manipulation technique suggested by Dawson⁵ (1996), employed in the present study, there are three possible reasons for the occurrence of pain in patients when firm pressure is applied: bad positioning of the condyle, improper alignment between the condyle and its disk, and joint pathology.

Many other factors influencing the CR recording are also observed in the literature², including physical or emotional stress, pain affecting the TMJ and other components of the masticatory system, neuromuscular conditioning, manipulation or guidance of the operator, soft tissue alterations, different examiners and different recording methods.

Some evidence suggests that the CR position may vary with time and the different periods of the day. Latta¹¹ (1992) reported that recordings in edentulous patients demonstrated differences in the condylar position throughout the day as high as 2.63 mm. Shafagh et al.²⁰ (1975) reported that different outcomes were observed when the CR recordings were performed in dentate patients at day and at night, probably due to the daily variation of shape and synovial fluid.

During CR recording in this study, after placement of the anterior stop, the examiners reported an easier manipulation when compared to the recording without anterior stop, although no significant difference was detected. According to Mezzomo, Frasca¹⁴ (1996), depending on the intensity of pain and the degree of muscle hyperactivity, manipulation of the mandible aiming at reaching CR is difficult at first. Thus, allowing the patient to rest for 10 to 15 minutes with no dental contact may be helpful for neuromuscular deprogramming. As previously mentioned, this procedure may increase agreement, yet it did not yield any significant differences in the present study.

It is important to distinguish between the two types of agreement evaluation: one refers to the reliability of each examiner when performing the same task different times (intraexaminer), while the other indicates whether this same reliability also exists between examiners when observing the same variable (interexaminer).

Concerning interexaminer evaluation with distinction between groups (Table 2), in general the

TABLE 3 - Agreement value (W) for the study variables within the same examiner during the 1st and 2nd evaluations (intraexaminer evaluation).

Evaluated item	Examiner 1	Examiner 2	Examiner 3
Frontal deviation (WOAS)	0.33	0.33	0.43
Sagittal deviation (WOAS)	0.29	0.13	0.01
1 st contact (WOAS)	0.60	0.65	0.53
Frontal deviation (WAS)	0.40	0.48	0.48
Sagittal deviation (WAS)	0.59	0.31	0.08
1 st contact (WAS)	0.70	0.66	0.47

WOAS: without anterior stop; WAS: with anterior stop.

agreement levels were not very similar. Yet, this study did not aim to discuss the validity of the clinical employment of CR as a therapy for TMJ pathosis. It is known that TMJ internal derangements may cause the joint structure to become more sensitive to alterations in condylar position.

The items sagittal deviation (with or without anterior stop) presented the same agreement levels, maybe because of the more difficult observation, since this analysis was performed through lateral visualization of the posteroanterior slide of the mandible when assuming the intercuspation position. This smaller agreement points toward the need to be careful when this item is regarded alone as the parameter for comparison between groups.

Except for the items sagittal deviation with and without anterior stop, especially in asymptomatic patients, and for the possible report of pain during manipulation, no detectable statistical differences were found between groups I (asymptomatic) and II (symptomatic).

As regards the intraexaminer evaluation (Table 3), the agreement levels were generally smaller than the interexaminer values, suggesting the possibility that the time period of one month between the first and second evaluations may have affected the accuracy of the manipulation technique and observation of the study items for all three examin-

ers, which is in agreement with previous studies^{18,19}.

In spite of the relatively poor agreement, the frontal deviation revealed an even intraexaminer agreement for the three examiners. This noticeably lower level of agreement for the item sagittal deviation for both intra- and interexaminer evaluations possibly demonstrates the more difficult observation of such item by the examiners. Thus, it may be stated that the calibration program was effective for the achievement of agreement between examiners. Yet, after one month, these values were reduced, even though still maintaining acceptable levels. This difference may probably have occurred due to natural alterations affecting the joint structures, related to the synovial fluid, disk shape and muscular condition. This also leads us to question the adoption of CR as a rigid position, absolutely required for stomatognathic health. The difficulty to judge some important items and the report of pain in patients with TMD may suggest that this position might just be an initial guide for extensive prosthetic and occlusal procedures, yet being highly susceptible to individual variation.

CONCLUSIONS

Considering the results obtained in the present study, it can be concluded that:

1. The training and calibration programs demonstrated to be efficient for the achievement of interexaminer agreement in CR recording.
2. The main difficulty experienced by the examiners was related to sagittal deviation, which consequently demonstrated the lowest agreement values.
3. Time and the physiological variation of the stomatognathic system led to a lower level of intraexaminer agreement.
4. Patients presenting with temporomandibular dysfunctions do not present differences in the reproducibility of CR position when compared to normal patients.

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