SUMMARY

Introduction: The centric relation (CR), as the most stable musculoskeletal position of the mandible, has become a sought-after target of orthodontic treatment. Centric occlusion (CO), occlusion of opposing teeth when the mandible is in the CR, may (but does not have to) coincide with the maximal intercuspal position (MIP). The presence of premature contacts may result in condylar displacement (CD) from the CR to a more stable MIP in response to an unstable condyle position. It has been proposed that an articulator be used when planning orthodontic treatment to better assess the relationship between occlusion and position of the condyles. The identification and assessment of CD is possible when using a mandibular position indicator (MPI) or a condylar position indicator (CPI). The dependence of CD on the maxillofacial structure is of great importance for the clinician in order to be able to assess the risk of an increased CD. Current knowledge concerning the relationship between malocclusions and cephalometric variables with an increased risk of CD is still lacking.

Aims:

1. Analysis of the impact of the maxillofacial structure and occlusal conditions on the position of the articular heads of the condylar processes of the mandible in the MIP and the comparison of the CR and MIP in patients before orthodontic treatment.

2. Collect available literature on the position of the articular heads of the condylar processes of the mandible and CD in the context of the maxillofacial structure and malocclusion.

Materials and methods: The studied group consisted of 48 patients (median age of 17.75 years). Contact points of opposing teeth in the MIP were assessed by hand-held casts. Condylar displacement in three spatial planes was assessed on models mounted in an articulator using an MPI. Nonparametric tests were used in the statistical analysis of quantitative variables. Comparisons between the two subgroups were performed using Mann-Whitney tests, while Kruskal-Wallis tests were used to compare larger subgroups, supplemented with post hoc tests according to Dwass-Steele-Critchlow-Fligner. Relationships between pairs of quantitative variables were determined using Spearman's nonparametric correlation coefficients. The relationship between qualitative or ordinal variables were assessed by Pearson's χ^2 Independence tests. Statistical hypotheses were verified at a significance level of 0.05.

This scoping review was conducted by analyzing the PubMed, Cochrane Library, Web of Science, and Scopus electronic databases up to February 2022 using a PICO (Population, Intervention, Comparator, Outcomes) strategy. Key words were as follows: population - orthodontic patients; intervention - MPI, CPI, mounting models; comparison - between patients with different maxillofacial morphologies and different types of malocclusions; outcome - CD in MIP and CR. Studies providing knowledge on the impact of the maxillofacial structure and malocclusion on CD were search targets. Literature selection was carried out according to the PRISMA-ScR checklist. Methodological quality of the selected studies was evaluated using the JBI Critical Appraisal Tool.

Results: A Pearson's χ^2 test of independence showed no significant correlation of CD with cephalometric measurements of a lateral cephalometric radiograph (ANB, SN-ML angles, SGo/NMe ratio). However, a correlation was found between the CD in the transverse axis and the mandibular plane angle SN-ML (p=0.033). A correlation was also found between CD in the anteroposterior axis and a shift of the midline of the mandible (p=0.041). The results revealed a relationship between Angle's classification of molar position on the right side and anteroposterior (Δx) CD values (p=0.006).

The scoping review of the electronic databases search revealed 2321 records. After applying eligibility criteria and JBI assessment, a total of 10 studies were included in this review. The review was divided into 5 parts that evaluated CD correlations depending on the maxillofacial structure in different vertical and sagittal skeletal patterns and malocclusions in the vertical, horizontal, and transverse planes.

Conclusion: Cephalometric measurements (ANB, SN-ML angles, SGo/NMe ratio) do not provide sufficient information to predict the frequency, size, and direction of CD at the level of the condylar processes. Model analysis in an articulator allows to diagnose the size and direction of the CD and is particularly desirable in patients with Angle class I, in whom an anterior CD may mask the occurrence of an Angle class II in CR. In addition, it allows an assessment of whether the malocclusion is the result of an eccentric shift of the mandible, in which the asymmetrical CD results in a shift of the midline of the mandible.

Based on available literature, the clinician may expect a larger CD in hyperdivergent facial patterns than in hypodivergent ones in both vertical and horizontal directions. Vertical displacements of the condyles in this group of patients are greater and occur more often in relation to displacements in the anteroposterior plane. The condyles are usually displaced posteroinferiorly. However, forward displacement can be expected in hypodivergent patients. Ultimately the results of the studies are varied and more research is warranted on this topic.