

Original Research

Occlusal scheme in complete dentures: A systemic review

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ABSTRACT:

Aim: The aim of this study was to qualitatively review the literature regarding occlusal schemes for complete dentures.

Methodology: An electronic search was executed using PubMed (MEDLINE) with the aid of Boolean operators to combine the following terms: “complete denture,” “occlusion,” “balanced,” “lingualized,” “anatomic,” “flat,” “monoplane,” and “canine.” The search was limited to English peer-reviewed articles published up to January 2021. The literature search was supplemented by manual searching of relevant journals and the reference lists of selected articles. **Results:** A total of 565 articles were retrieved; however, only 12 articles met the inclusion criteria. The included studies evaluated the effects of posterior tooth morphology/arrangement and lateral occlusal guidance. In relation to morphology, the posterior teeth were either anatomical or flat. The posterior tooth arrangements showed conventional bilaterally balanced occlusion (CBBO), lingualized bilaterally balanced occlusion (LBBO), or monoplane occlusion (MO). The lateral occlusal guidance involved either balanced occlusion or anterior tooth-guided occlusion (ATGO). **Conclusion:** It can be concluded that anatomical teeth arranged in CBBO or LBBO are preferable to flat teeth arranged in MO. This is primarily related to patient acceptance. ATGO can also be considered for complete dentures.

Keywords: occlusion, edentulous, complete denture, esthetics.

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INTRODUCTION

Removable complete denture (CD) occlusal schemes have a varied perception in terms of satisfaction and oral-health-related quality of life in patients.¹ The three pillars for the success of removable dentures are retention, stability and support, which directly affect the function, phonetics and aesthetic of patients. The factors are equally associated with restorations in both arches but complicated in the mandibular arch. Problems are associated with artificial dentures of both conventional and implant-supported categories with continuous denture use.² However, the use of tissue-friendly techniques and materials can improve the patient satisfaction level and biocompatibility.³

Occlusion is an integral component of complete denture biomechanics. Satisfactory occlusal scheme prescription is a supporting factor to a better removable complete denture outcome in patients. It is evident that adjusting the occlusion clinically and in laboratory increases patients' acceptance with time.⁴ Numerous occlusal schemes for removable complete dentures are in practice, including bilateral balanced occlusion (BBO), lingualized occlusion (LO), buccal occlusion (BO), monoplane occlusion (MO), group function/unilateral balanced (GF) and canine-guided occlusion (CGO). Occlusal schemes are diversified and continuously changing over time; hence today's restorative dentists are in a state of uncertainty as to

which occlusal schemes can be satisfactorily incorporated in dentures.⁵ Occlusal schemes are primarily selected on the basis of the amount of ridge resorption in the upper or lower dental arches and the state of the stomatognathic system. In addition, certain systemic conditions are associated with specific occlusal schemes. For example, MO is particularly used in muscle disorders⁶, while LO is believed to serve better in resorbed ridges compared to BBO. BO is associated with improved chewing ability and patient preference for a variety of foods. BBO is associated with better stability, retention and support of removable complete dentures.⁷ There are studies reporting the limitations of LO and BBO due to the lack of patient satisfaction particularly in removable dentures⁸, which creates room for further investigation to rule out the possibility of other occlusal schemes. The use of removable complete dentures will not reduce in the future; hence researchers must focus on a reliable occlusal scheme that has maximum outcome in terms of quality patient service.⁹ CGO is considered less problematic in terms of occlusal interferences, esthetics, occlusal surface contacts in denture teeth and satisfaction levels with simple occlusal adjustments.¹⁰ Altering the posterior tooth morphology and occlusal scheme has been suggested to impact the lateral forces on the denture and residual ridge. It has been argued that any occlusal force applied to one segment of the denture must be balanced by force applied to the other denture segment, i.e., balanced occlusion.¹¹ In contrast, some authors have proposed the use of flat teeth to minimize lateral forces and enhance denture stability.¹² This principle is justified from a mechanical perspective; however, it is not necessarily justified from biologic and physiologic perspectives. Although complete dentures have been used in prosthodontics for centuries, there is still a lack of compelling evidence supporting any one occlusal philosophy.¹³ A systematic review of complete denture occlusion¹⁴ found that only one study complied with the inclusion criteria.¹⁵ Recently, clinical studies have assessed the effect of varying the occlusal parameters for complete dentures.

AIM OF THE PRESENT STUDY

The aim of this systematic review was to qualitatively assess the effect of the occlusal schemes of complete dentures in relation to patients' subjective appraisals and clinicians' objective evaluations of treatment. The points of interest were posterior tooth morphology, posterior tooth arrangement, and lateral occlusal guidance.

METHODOLOGY

A comprehensive literature search was completed in January 2021. The search strategy was conducted using the PubMed (MEDLINE) database with the aid of Boolean operators. The following key words were combined: "complete denture," "occlusion,"

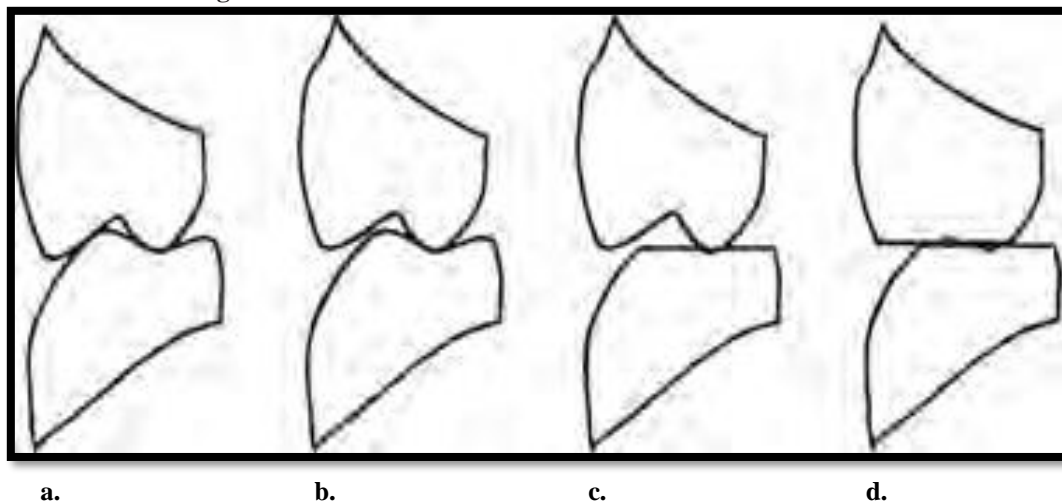
"balanced," "lingualized," "anatomic," "flat," "monoplane," and "canine." No limits were placed regarding year of publication. The search aimed to obtain all clinical studies that compared different denture posterior tooth morphologies, posterior tooth arrangements, or lateral occlusal guidance schemes. Further, an electronic search was manually conducted of the following journals: International Journal of Prosthodontics, Journal of Prosthetic Dentistry, Journal of Oral Rehabilitation, International Journal of Periodontics and Restorative Dentistry, Journal of Dentistry, Quintessence International, Journal of Prosthodontics, and Journal of Prosthodontic Research. In addition, the references of the selected articles were searched for relevant studies. Potentially relevant studies were identified according to the titles and abstracts. The full-text articles were subsequently reviewed and cross-matched against the predefined inclusion criteria. The electronic search identified 565 articles. Following analysis of the titles and abstracts, 530 articles were excluded, leaving only 35 articles suitable for inclusion. After the application of the inclusion criteria, 16 articles were deemed suitable for full-text analysis. Of these, 8 articles were found to be acceptable for inclusion. The manual searches revealed an additional 4 articles. Two of the studies were performed on the same participants; however, both studies were included because they applied different assessment methods. Therefore, a total of 12 articles were considered acceptable for this systematic review.¹² Since the selected studies differed markedly in relation to study design, a qualitative analysis of the studies was conducted. The analysis was primarily related to the significant variations in tooth selection, tooth morphology, follow-up period, and assessment method.

RESULTS

For the purpose of uniformity, the studies were classified into two broad categories according to the occlusion variables assessed: (1) posterior tooth morphology and arrangement and (2) lateral occlusal guidance. The posterior tooth arrangements involved conventional bilaterally balanced occlusion (CBBO), lingualized bilaterally balanced occlusion (LBBO), or monoplane occlusion (MO). CBBO can be defined as the simultaneous occlusal contact of the maxillary and mandibular teeth in centric and eccentric positions. This occlusal scheme is distinguished by the establishment of occlusal contacts between mandibular buccal cusps and maxillary central fossae and between maxillary palatal cusps and mandibular central fossae.¹¹ While still considered a balanced tooth arrangement, LBBO is characterized by maxillary palatal cusps contacting mandibular central fossae. It differs from CBBO by eliminating the contacts between the mandibular buccal cusps and maxillary central fossae. The selected studies accomplished LBBO by modifying the anatomical mandibular posterior teeth and tilting the maxillary

posterior teeth or by applying anatomical maxillary posterior teeth against flat mandibular posterior teeth. (Figure 1)

Figure 1- Altering posterior tooth morphology and arrangement: (a) anatomical maxillary and mandibular teeth arranged in CBBO; (b) anatomical maxillary and mandibular teeth arranged in LBBO; (c) anatomical maxillary tooth and flat mandibular tooth arranged in LBBO; (d) flat maxillary and mandibular teeth arranged in MO.



Regarding MO, balanced or unbalanced occlusion can be established, but the selected studies did not clarify the nature of lateral occlusal guidance. A special feature of MO is that the occlusal contacts comprise surfaces rather than points. In relation to posterior tooth morphology and arrangement, one study compared LBBO with MO. The LBBO was composed of anatomical maxillary teeth against flat mandibular teeth. Two studies compared LBBO with CBBO. The LBBO was formed by altering the mandibular teeth to eliminate the contacts of the mandibular buccal cusps. Two studies compared MO with CBBO. Two studies of the same participant group compared CBBO, LBBO, and MO. The crossover study by Brewer et al¹³ was the only study to find more patients who preferred MO to CBBO. After an objective comparison, the randomized prospective study by Matsumaru¹⁶ found that LBBO was more efficient in

terms of mastication and preservation of intercuspal position for patients with severe alveolar bone resorption. However, the same study found no differences between LBBO and CBBO for patients with less severe alveolar bone resorption. In relation to tooth guidance, three studies compared ATGO with CBBO, and one compared canine guidance with LBBO. The crossover study by Peroz et al found that dentures with anterior tooth guidance are subjectively more satisfying to patients than those with CBBO in relation to esthetics, mandibular denture retention, and chewing ability.¹⁷ After comparing LBBO and ATGO, Heydecke et al found that subjective assessments revealed a patient preference for complete dentures with ATGO in relation to chewing tough food. However, the crossover study by Rehmann et al showed the opposite outcome. (Table 1)

Table 1- Summary of Included Studies Assessing the Effect of Posterior Tooth Occlusal Morphology and Arrangement

Study	Tooth form	Tooth arrangement
Brewer et al	Anatomical (cusp angle not specified) Flat	CBBO MO
Clough et al	Anatomical maxillary (30 degrees) against flat mandibular Flat	LBBO MO
Shetty et al.	Anatomical (cusp angle not specified) Flat	CBBO MO
Kimoto et al	Anatomical (20 degrees) Anatomical (20 degrees)	CBBO LBBO
Matsumaru et al.	Anatomical (33 degrees) Anatomical (33 degrees)	CBBO LBBO

*CBBO = conventional bilaterally balanced occlusion; LBBO = lingualized bilaterally balanced occlusion; MO = monoplane occlusion

DISCUSSION

Although complete dentures are one of the most basic prosthodontic treatments, many important treatment variables have not been scientifically validated. Today, complete denture treatment is faced with numerous challenges, including the scarcity of expertise regarding high-quality complete dentures, greater proportions of elderly patients with a significant need for advanced care, and lack of sound evidence supporting specific guidelines.⁸ In general, anatomical teeth are preferred over flat teeth in both subjective and objective assessments. According to patients' subjective evaluations, almost all included studies reported the superiority of anatomical teeth arranged in CBBO or LBBO in comparison to flat teeth arranged in MO. Shetty found that flat teeth arranged in MO were associated with a more prognathic mandibular appearance in 87.5% of patients. Other possible advantages of anatomical teeth were a reduction in cheek biting, speech improvement, and cleansability.¹² Although flat teeth are reported to enhance denture stability,¹³ one study revealed that only 12.5% of patients noticed such a benefit. Interestingly, the preference for anatomical teeth over flat teeth may be caused purely by esthetics. The objective assessments were generally limited in the included studies. There is a possibility that anatomical teeth arranged in balanced occlusion require less chairtime for clinical adjustments than flat teeth arranged in MO.¹² However, this assumption cannot be confirmed due to the lack of statistical differences. If such a difference exists, it may be related to the presence of cusp height, with contact points that facilitate occlusal adjustment in comparison with flat teeth, which exhibit contact surfaces. Sufficient cusp height allows for selective occlusal grinding to eliminate interferences.¹¹ Kimoto et al, found that alveolar bone level influenced masticatory performance. This finding is supported by Matsumaru,¹⁵ who found that LBBO is advantageous for patients with severe ridge resorption in terms of masticatory efficiency and preservation of intercuspal position. However, the same study found no such difference for patients with moderate resorption. These results are in accordance with other investigations showing that the alveolar bone level can influence the success and patient acceptance of complete dentures. Therefore, it appears that as long as the teeth are anatomical in shape, different posterior tooth arrangements for complete dentures are equally acceptable. LBBO is more advantageous than CBBO in cases of severe resorption. Heydecke et al⁷ supported the idea that complete dentures with ATGO enhance chewing efficiency, especially for harder foods. Another study revealed no difference in chewing efficiency between the two schemes. Rehmann et al¹⁷ found that balanced occlusion may enhance patient adaptation in the early phase of denture insertion. The authors attributed this benefit to the enhanced stability of dentures with balanced

occlusion. Over time, however, this difference tended to diminish. Interestingly, the two studies reporting the superiority of ATGO included the first premolar in the lateral occlusal guidance. The difference between the subjective and objective assessments illustrates the impact of esthetics on denture acceptance. It is possible that many patients prefer ATGO because it allows for a more esthetic appearance. It seems that the effects of lateral occlusal guidance have been exaggerated and the available clinical trials failed to identify the superiority of any lateral occlusal scheme. Therefore, even though the objective assessments were inconclusive, patient acceptance of complete dentures with ATGO may be related to superior esthetics and the patient's improved perception of the overall treatment.

CONCLUSION

The use of anatomical teeth in CBBO or LBBO is equally acceptable to patients in relation to masticatory ability, esthetics, comfort, and speech. There is some evidence that LBBO is beneficial for patients with severely resorbed ridges in terms of mastication and stability. ATGO can be cautiously considered as an option for lateral occlusal guidance of complete dentures; however, clear clinical and technical guidelines are still needed. Esthetic factors may affect patient perceptions of the occlusal scheme.

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