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Complete Denture Occlusion: An Evidence-Based Approach

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Keywords
Bilateral balanced occlusion; canine guidance; conventional complete denture.

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Abstract

Purpose: This study involved an extensive search for randomized controlled clinical trials comparing bilateral balanced and canine-guided dentures, and questioned whether a bilateral balanced occlusion is imperative for successful denture treatment.
Materials and Methods: Studies were identified by searching electronic databases (PubMed/MEDLINE, ISI Web of Science, LILACS, and BBD). The keywords "denture" and "occlusion" were used. The minimum inclusion requirements were (1) randomized controlled trials with patients of any age wearing both maxillary and mandibular conventional complete dentures (CDs), (2) comparison between bilateral balanced and canine-guided dentures, and (3) assessment of masticatory function and/or patients' satisfaction.
Results: The search resulted in the identification of 5166 articles. Subsequently, 5156 articles were excluded on the basis of title and abstract. By the end of the search phase, seven randomized controlled trials were considered eligible.
Conclusions: Current scientific evidence suggests that bilateral balanced occlusion is not imperative for successful treatment with conventional CDs in average patients. More studies are necessary to identify if specific clinical conditions may benefit from a balanced occlusion.

According to the American Dental Association, evidence-based dentistry is an approach to oral healthcare requiring the judicious integration of systematic assessments of clinically relevant scientific evidence with the dentist's clinical expertise and the patient's treatment needs and preferences.[1] Assessment of scientific evidence obtained from reliable sources may be the most challenging element for dentists to master. Clinical expertise is often obtained by practitioners engaging in clinical experiences over time. Patients' desires and preferences may be the result of many factors including perceived needs, past dental experiences, health values, and financial issues. Finally, it is essential that these three elements are present in order to obtain the greatest benefits.[1]

In the face of this new paradigm of clinical decision making, numerous clinical procedures have become questionable. In 2009, Carlsson[2] presented examples of "old truths" in the field of prosthodontics. One of these so-called "old truths" is the bilateral balanced occlusion (BBO), held by many authors as fundamental for successful treatment with conventional complete dentures (CDs). For more than a hundred years, textbooks and undergraduate teaching have stated that canine guided dentures should be avoided, since they would result in denture instability and impaired masticatory function; however, recent research has shown that conventional CDs can function successfully without a balanced occlusion.[3] Also, it is interesting to note that 1 year after the insertion of new dentures, balancing contacts are no longer present due to acrylic tooth wear and changes in supporting tissues, but patients do not complain about the situation.[4] The conception of BBO was not based on rigid scientific methods, but derived from clinical observation and repetition over the years. Although it does not mean it is incorrect, it seems that the needs and attitudes of individual patients may have been overestimated. If canine-guided dentures may be constructed with acceptable clinical results in a minimum amount of time and effort, clinicians should be aware of the evidence in order to make the decision that best suits their patients' needs.

Since investigations of high quality are required for valid comparisons between different methods, the purpose of this study was to accomplish an extensive search for randomized controlled clinical trials comparing bilateral balanced and canine-guided dentures, and question whether a BBO is imperative for successful denture treatment. Assessment of masticatory function and patient satisfaction were considered as treatment outcomes.

Materials and methods

Information sources

Studies were identified by searching electronic databases. The keywords "denture" and "occlusion" were used. No

limits were applied for language. This search was applied to PubMed/MEDLINE, ISI Web of Science, LILACS (Latin American and Caribbean Literature on the Health Science), and BBD (Brazilian Bibliography of Dentistry). Additional references from citations within the articles were obtained, and current textbooks were also used. Papers dated between 1950 and 2012 were selected. The last search was run on 12 January 2012.

Inclusion and exclusion criteria

The minimum inclusion requirements were (1) randomized controlled trials with patients of any age wearing both maxillary and mandibular conventional CDs, (2) comparison between bilateral balanced and canine-guided dentures, and (3) assessment of masticatory function and/or patients' satisfaction. Clinical reports, reviews, and short communications were excluded.

Review methods

All reports identified by the search were printed and independently analyzed once by each of the two reviewers on the basis of title, keywords, and abstract (when available) to check if the study was likely to be relevant. Full reports of all relevant papers and all papers that could not be classified were obtained. In cases of disagreement, a third reviewer was consulted to achieve consensus. The reviewers were not blinded as to authors, journals, date of publication, financial support, or results. The inclusion criteria were applied, data assessed, and then independently extracted by two reviewers. Consensus was sought in cases of discrepancy.

Results

The search resulted in the identification of 5166 articles. Subsequently, 5156 articles were excluded on the basis of title and abstract. Of the 10 studies considered to be potentially relevant for this review, one article[5] was excluded because it was not possible to retrieve the full text. Thus, the full texts of nine studies were screened. During full-text screening, two articles were excluded. One article[6] was not a randomized controlled trial, and the other[7] did not meet the inclusion criteria for assessment of masticatory function and/or patients' satisfaction. By the end of the search phase, seven randomized controlled trials were considered eligible. Their data were the basis of this review (Table 1). Figure 1 is a flow chart of studies assessed and excluded at various stages of the review.

Discussion

The issue about which occlusal concept is the most appropriate for individual needs is clinically and economically relevant. For the dentist and dental technician, the construction of a set of dentures with BBO is more complex and time consuming than construction of canine-guided dentures. Achieving BBO during the arrangement of prosthetic teeth and clinical adjustments is more complicated, making it reasonable to use technical procedures that produce acceptable clinical results with minimum time and effort.

Of the seven clinical trials identified,[3,8–13] six presented a crossover design.[3,8,10–13] This design is common in medical and dental human subject research. A crossover design eliminates inter-subject response variation to the same treatment, because all treatments are applied to all participants. This increases the statistical efficiency of the study, given the need for a smaller number of patients. Because all patients work as their own control, the crossover design allows the reduction of the effect of noncontrolled variables such as gender, previous denture experience, health status, resiliency of the mucosa, and alveolar ridge height and width. Those advantages aside, crossover trials do present a carry-over effect. While a washout period is necessary in pharmacological trials, carry-over effects are unlikely in oral rehabilitation. Leaving patients without dentures for a washout period was not considered possible for ethical reasons. Therefore, a washout period was not included in any of the studies. To avoid bias, three studies[3,11,12] presented two groups with different treatment sequences while in one study the occlusal concept was changed daily.[13]

Two occlusal concepts exist in CD treatment: BBO and canine guidance. Both include simultaneous contact in centric occlusion, but they differ in eccentric movements. It was supposed that BBO would provide greater masticatory efficiency by bringing a larger amount of grinding surfaces into contact at each movement.[14] However, none of the three clinical trials investigating the influence of occlusal concepts on masticatory efficiency supported this assumption.[3,8,9] In Trapozzano's study[8] ($n = 12$), nine patients showed greater masticatory efficiency with balanced occlusion, but the degree of difference was decisive in only two of them. In three patients the masticatory efficiency was slightly greater with the nonbalanced occlusion. Differences were observed only when carrots were used as test food, but not for peanuts. In Farias Neto et al,[3] 24 edentulous patients requiring new dentures were randomized into two treatment groups with different treatment sequences. The dentures were fabricated in accordance with traditional techniques and in cooperation with undergraduate dental students. Anatomically shaped acrylic teeth with a 33° cuspal inclination were used. The change from BBO to canine guidance of all dentures was performed clinically by the same dentist by the addition of light-cured composite resin in the lower canines. To reestablish BBO, the composite resin was removed. Patients were subjected to both occlusal concepts for equal 3-month periods. The colormetric method, with capsules of a synthetic material enclosing fuchsine-containing granules, was used to perform a masticatory efficiency test. A method for quantifying the overall satisfaction of conventional CD wearers was used. Patients were asked to respond to questions with three-grade answers (well satisfied, satisfied, dissatisfied) regarding 12 factors: "chewing, tasting, speech, pain (upper and lower), esthetics, fit (upper and lower), retention (upper and lower), and comfort (upper and lower)."[3] No difference was observed between bilateral balanced and canine guided dentures.

The relationship between masticatory efficiency and subjective chewing experience has been shown to be weak or absent.[15] Thus, masticatory function must be evaluated in both manners, especially in edentulous patients due to the importance of psychological factors for successful treatment.[2] Two

Table 1 Randomized controlled trials comparing bilateral balanced and canine guided dentures

Author, year, location of study	Study design	Outcomes	Results
Trapozzano, 1960, US[8]	N = 12[a] (age range: 55-70). Inclusion criteria: previous denture experience. Exclusion criteria: not reported.	Masticatory efficiency and patients' rating of chewing ability.	No difference.
Motwani and Sidhaye, 1990, India[9]	N = 60 (age: not reported) Inclusion criteria: previous denture experience. Exclusion criteria: anomalous jaw relations.	Masticatory efficiency.	No difference.
Compagnoni et al, 2002, Brazil[10]	N = 15[a] (mean age = 65 years) Inclusion criteria: previous denture experience. Exclusion criteria: poor prognosis.	Patients' rating of chewing ability.	No difference.
Peroz et al, 2003, Germany[11]	N = 22[a] (mean age = 67 years) Inclusion criteria: patients requiring new dentures. Exclusion criteria: not reported. 21 patients had previous denture experience.	Patients' rating of esthetic appearance, denture retention, and ability to chew and speak.	Better results for canine-guided dentures.
Heydecke et al, 2007, Germany[12]	Single-blind study N = 20[a] (age range: 50-85) Inclusion criteria: patients requiring new dentures. Exclusion criteria: symptoms of TMD, xerostomia, orofacial motor disorders, severe oral manifestations of systematic diseases, psychological or psychiatric conditions that could influence their response to treatment. All patients had previous denture experience.	Patients' rating of chewing ability.	Better results for canine-guided dentures.
Rehmann et al, 2008, Germany[13]	Single-blind study N = 38[a] (age range: 50-87 years). Inclusion criteria: patients wearing CDs for at least 6 months with insufficient occlusion. Exclusion criteria: CD cases with adequate BBO or canine guidance.	Patient satisfaction.	Better results for balanced dentures.
Farias Neto et al, 2010, Brazil[3]	Double-blind study N = 24[a] (mean age = 60 years) Inclusion criteria: patients requiring new dentures. Exclusion criteria: symptoms of TMD, xerostomia, orofacial motor disorders, severe oral manifestations of systematic diseases, psychological or psychiatric conditions that could influence their response to treatment. All patients had previous denture experience.	Masticatory efficiency and patient satisfaction.	No difference.

[a]Crossover design.

studies presented no difference for patients' rating of their chewing ability,[8,10] while two studies presented better results for canine-guided dentures.[11,12] In a randomized crossover clinical trial of 22 patients, subjective data were collected using 100-mm visual analogue scales to describe patient satisfaction with esthetic appearance, ability to chew, ability to speak, and denture retention.[11] All dentures were constructed with anatomic teeth. Each occlusal concept was worn for 3 months. Patients assessed canine-guided dentures to be significantly more satisfying in esthetic appearance, mandibular denture retention, and chewing ability.[11] Heydecke et al[12] compared a simplified balanced occlusion, called lingualized occlusion, to first premolar/canine-guidance. Edentulous patients (n = 20) received two sets of new CDs. One pair was manufactured based on intraoral tracing of centric relation, facebow transfer, and semi-anatomical teeth with lingualized occlusion. The second pair was made using a simplified procedure without facebow transfer; jaw relations were recorded with wax occlusion rims, and anatomical teeth with a first premolar/canine-guidance were selected. Patients were blinded to study group and were not informed about the differences between the two types of dentures. The dentures were delivered in randomized order, and each was worn for 3 months. Patients' rating of chewing ability was significantly better with nonbalanced dentures.[12]

Proponents of BBO believe that this occlusal concept is important for denture retention and stability.[14] Because the highest incidence of oblique forces capable of dislodging dentures occurs during mastication, it was supposed that canine-guided dentures would impair masticatory function; however,

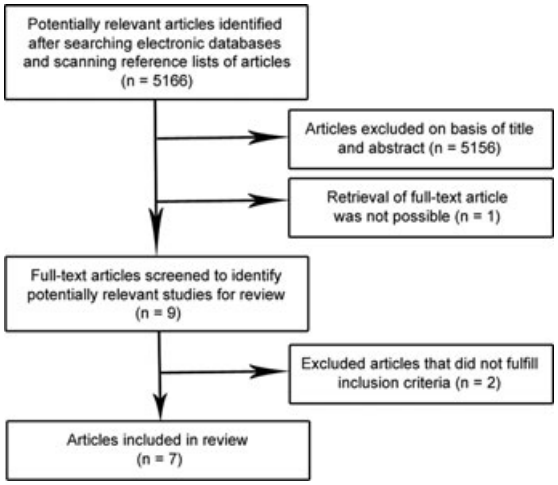

Figure 1 Studies assessed and excluded at various stages of the review.

clinical trials identified in this review suggest that the occlusal concept of conventional CDs is not as crucial as often anticipated for long-term clinical success in terms of masticatory efficiency,[3,8,9] chewing experience,[8,10–12] and patient satisfaction.[3,13] In a single-blind study with 38 edentulous patients, patient satisfaction was assessed in the initial phase after fitting new CDs.[13] After 2 and 4 weeks, 63% and 47% of the patients preferred BBO, and 5% and 11% preferred canine guidance, respectively. According to the authors, the BBO may help patients adapt to their new oral situation; however, with ongoing time during adaptation, the difference between both occlusal concepts becomes more and more insignificant.[13] Balancing contacts are not found during mastication and probably are not physiologically necessary. With the food bolus between the teeth, the occlusal surfaces do not make contact with each other, but with the food. Also, during functional activities such as drinking, speaking, or singing, there is no balancing contact. It is possible that patients presenting parafunctional habits may benefit from balancing contacts, but this assumption remains to be investigated.

According to Pound,[16] BBO centralizes forces on the residual alveolar ridges to protect alveolar bone from resorption. No clinical trials have investigated that association. It is difficult to accomplish long-term controlled trials evaluating the influence of occlusal concepts on bone resorption due to patients' age and many other variables. It has been explained that BBO protects against bone resorption because it promotes symmetrical distribution of stress on the alveolar ridges; however, because during mastication there is no balancing contact, there is no force distribution on both sides of the arches. To avoid these problems in denture retention, stability, and bone resorption, it seems to be more reasonable for clinicians to instruct patients to not incise, to put small pieces of food in the mouth, and to masticate on both sides of the arch.

To summarize, the critical appraisal of the literature reveals no scientific evidence to support the BBO as the ideal occlusal concept for conventional CDs. Current evidence suggests that the occlusal concept has little influence on clinical outcomes or patient satisfaction. Additional randomized controlled clinical trials should be developed taking into account the influence of mucosal resiliency, alveolar ridge anatomy, and parafunctional activities on occlusal concept choice.

Conclusions

Current scientific evidence suggests that BBO is not imperative for successful treatment with conventional CDs in average patients when masticatory function and patient satisfaction are considered as treatment outcomes. More studies are necessary to identify if specific clinical conditions may benefit from a balanced occlusion.

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