



## Occlusion Concept for Fabricating Complete Denture

### (Literature Review)

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### Abstract

**Introduction:** Patients with full edentulism experience difficulties in chewing food, thus requiring complete dentures aiming to restore the missing teeth, other structures, and the patient's masticatory efficiency. Complete denture fabrication requires retention, stability and support of the remaining tissues. This is influenced by the selection of a good occlusion concept. There are several types of occlusion concepts such as Bilateral Balanced Occlusion (BBO), Lingualized Occlusion (LO) and Canine Guided Occlusion (CGO).

**Purpose:** The aim of this literature review was to determine the use of the ideal occlusion concept in complete dentures according to the patient's condition. **Methods:** Literature was selected using the databases PubMed, Science Direct, Wiley Online Library, Elsevier, and Google Scholar from January 2007 to December 2022. Articles that met the inclusion and exclusion criteria were assessed using the Cochrane Collaboration Tool for bias assessment and summarized to obtain data on occlusion concept for fabricating full denture. **Results:** Fourteen randomized controlled trial journals discussing about three occlusion concepts that are BBO, LO and CGO were included in this literature review. Occlusal concept should be used according to the indication and condition of the patient. **Conclusion:** Occlusion concepts give positive impact if chosen wisely according to the patient's condition.

**Keywords:** balanced occlusion; canine guided occlusion; complete denture; lingualized occlusion; occlusion concept

### Introduction

A full denture is a denture used to replace all missing natural teeth and other structures in the upper and lower jaw.<sup>1</sup> Full dentures are generally made for geriatric patients or some patients born with congenital diseases and less perfect edentulous arches.<sup>1,2</sup> A full denture serves to restore the appearance of natural teeth, mastication, speech, and occlusion of the upper and lower jaw.<sup>1</sup> To establish good retention, stability, and support for denture, an ideal occlusion concept is required in order to improve the patient's psychological comfort and the time using of the denture.<sup>3</sup> An occlusion concept is a plan for shaping the tooth arrangement that will be used when occluding. The selection



of the occlusion concept is customized to the patient's condition. Various occlusion concepts have been known in the field of prosthodontics, such as bilateral balanced occlusion (BBO), lingualized occlusion (LO), monoplane occlusion, and canine-guided occlusion (CGO).<sup>4,5</sup>

Bilateral Balanced Occlusion (BBO) is an occlusion concept with bilateral occlusal contacts on the anterior and posterior teeth that occur simultaneously in the centric and eccentric states. Balanced occlusion is the ideal occlusion concept to be achieved in full denture manufacturing.<sup>6</sup> The concept of balance in balanced occlusion is the contact of the upper buccal cusp with the lower buccal cusp on the working side and the upper lingual cusp with the lower buccal cusp on the non-working side.<sup>7</sup>

In another occlusion concept, LO, only the palatal cusp of the maxillary posterior teeth contacts the fossa of the mandibular posterior teeth, which is generally done on the second premolar, first molar and second molar so that there is no contact on the buccal cusp of the maxillary and mandibular posterior teeth.<sup>6,8</sup> Lingualized occlusion provides a more natural appearance to the upper premolars and better chewing ability than monoplane occlusion.<sup>6</sup> The preparation of this type of occlusion is simpler because there are fewer teeth in contact.<sup>9</sup>

Canine guidance occlusion (CGO) is a type of occlusion that separates the posterior teeth because only the canines make contact when in use. Canine guidance occlusion protects the occlusion from eccentric pressure.<sup>10</sup> The anterior teeth protect the posterior teeth during eccentric movements and the posterior teeth protect the anterior teeth during occlusion.<sup>11</sup> Canine guidance does not overload the posterior teeth so that the masticatory muscles work less.

The choice of occlusion concept varies depending on the patient's condition. The BBO concept is recommended in patients with normal alveolar ridge height because it is concerned to cause resorption of the ridge.<sup>12,13</sup> Based on research by Brandt et al (2019), the mandibular margins of balanced occlusion patients experienced more severe resorption due to the large lateral pressure.<sup>14</sup> Lingualized occlusion favors esthetics, improves chewing ability, and produces less horizontal force in patients with severe alveolar bone



resorption.<sup>15</sup> Khan et al (2022) stated that masticatory efficiency in dentures with the LO concept is better than dentures with the BBO concept.<sup>16</sup> This statement is in accordance with research conducted by Ahmed et al (2013) which states that the chewing efficiency of patients with the LO concept is better than that of complete denture users with the BBO concept because the LO concept has better functional and comfort in the patient's denture.<sup>5</sup> Based on research by Bolla et al (2017), the masticatory abilities of BBO and CGO are similar or not much different.<sup>17</sup> Based on the description above, this literature review was made to find out the use of the ideal occlusion concept in a complete denture according to the patient's condition.

## Methods

Literature review was made using Google scholar, DOAJ, Science direct, and pubmed data for the last 15 years calculated from 2007 to 2022. The articles used are in accordance with the inclusion and the exclusion criteria in table 1 which are then analyzed for bias assessment using the Cochrane Collaboration Tools and summarized to obtain data on the concept of occlusion in full denture making.

**Table 1.** Data search strategy

Inclusion Criteria	Population	Intervention/Exposure	Comparison	Outcome
<b>Keyword</b>	Full edentulous	Complete denture <sup>1</sup> Occlusal scheme <sup>2</sup> Bilateral balanced occlusion <sup>3</sup> Lingualized occlusion <sup>4</sup> Canine guided occlusion <sup>5</sup>	Bilateral balanced occlusion <sup>1</sup> Lingualized occlusion <sup>2</sup> Canine guided occlusion <sup>3</sup>	Masticatory ability <sup>1</sup> Masticatory efficiency <sup>2</sup> Comfort of the prosthesis <sup>3</sup> Satisfaction <sup>4</sup> Retention <sup>5</sup> Phonetics <sup>6</sup>
<b>Original Word</b>		1 : full denture 2 : occlusion, dental occlusion	-	Chewing
<b>Controlled Vocabulary</b>	Edentulous mouth, Edentulous mouths, toothless	-	-	-
Exclusion criteria	Population	Intervention/Exposure	Comparison	Outcome



<b>Keyword</b>	Partial edentulous, xerostomia, temporomandibular joint disorder	Implant <sup>1</sup> , fixed denture <sup>2</sup> , overdenture <sup>3</sup>	-	-
<b>Original Word</b>	-	-	-	-
<b>Controlled Vocabulary</b>	-	-	-	-

## Results

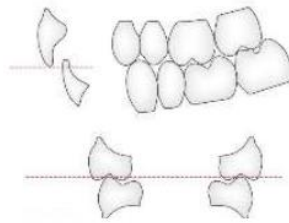
Article search results through the PubMed, Google Scholar, Elsevier, and Science Direct databases using the keywords Complete denture, Occlusal scheme, Balanced occlusion, Lingualized occlusion, Masticatory performance, Masticatory efficiency, Chewing activity, Chewing ability, Masticatory measures, Masticatory function, Masticatory ability, Stability, Edentulous mouth, Edentulous mouths, Full edentulous, Toothless, and Patient satisfaction obtained 13 randomized controlled trial (RCT) journals that discuss the effect of using the concepts of Bilateral Balanced Occlusion (BBO), lingualized occlusion (LO), and Canine Guided Occlusion (CGO) on full denture making. List of articles is shown in Table 2.

## Discussion

A full denture is used to replace missing teeth in edentulous patients so as to restore masticatory function and improve the patient's quality of life.<sup>18,19</sup> To establish good denture retention, stability, and support, an ideal occlusion concept is required in order to improve the patient's psychological comfort and the lifespan of the denture. Full dentures have a number of occlusion concepts that are selected based on the patient's condition, namely balanced occlusion, lingualized occlusion, and canine guided occlusion.<sup>20</sup>

The BBO occlusion concept is indicated in patients with normal alveolar plateau heights and rounded alveolar cusps.<sup>12,13</sup> The BBO occlusion concept (Fig. 1) is known as the ideal occlusion in conventional complete dentures, but it is difficult to achieve clinically<sup>21,22</sup> because it requires several considerations, namely the compensation curve,

occlusal plain, condylar guidance, incisal guidance, and cusp inclination so that all teeth can contact evenly.<sup>23, 24</sup>



**Figure 1.** Dental Arrangement with the Concept of Balanced Occlusion<sup>6</sup>

The preparation of a full denture with balanced occlusion using a cusp with an angle of  $30^\circ$  which produces lateral pressure so that it is concerned that it will worsen the condition of the margins that have resorbed and cause the patient to feel pain and discomfort when chewing.<sup>14,25</sup> This is consistent with the research of Brandt et al (2019) which states that the mandibular cusps of balanced occlusion patients experience more severe resorption due to the large lateral pressure.<sup>14</sup> In addition, the occlusal pressure generated is large so that muscle performance becomes heavier which causes patients to tire quickly when chewing.<sup>12,26</sup> The heavy muscle performance causes patients with parafunctional habits to be less advised to use balanced occlusion.<sup>27</sup> The concept of Lingualized Occlusion (LO) was first introduced by Alfred Gysi in 1927 for patients with posterior cross-bite.<sup>28</sup> Gysi reported 60% of edentulous patients at the University of Zurich clinic in the early 20th century had a posterior cross-bite caused by alveolar bone resorption.<sup>28</sup> Dentures with the concept of balanced occlusion were very difficult to apply to these patients so Gysi designed and invented the LO concept.<sup>28</sup> Payne reintroduced the LO concept in an improved form for use in 1941.<sup>29</sup> Payne modified the mortar and pestle concept by performing selective grinding of  $30^\circ$  on the cusps of the mandibular posterior teeth.<sup>3</sup> LO-concept dentures are indicated in patients who have severe alveolar bone resorption, have skeletal class 2 malocclusion, and have flabby supporting tissue.<sup>29</sup> The LO concept is also indicated in the use of a complete denture in one jaw and a removable partial denture in the other jaw.<sup>29</sup>

The advantage of the LO concept is that it can reduce horizontal pressure on the alveolar bone so that alveolar bone resorption does not get worse.<sup>30</sup> Research by Kawai et al (2016) states that patients with moderate alveolar bone resorption using the BBO concept and patients with severe alveolar bone resorption using the LO concept have the same masticatory ability, meaning that the use of the LO concept in patients with severe alveolar resorption provides better masticatory ability.<sup>15, 21</sup> The absence of contact at the buccal cusp can also reduce the occurrence of premature contact that usually occurs in conventional balanced occlusion so as to increase patient comfort and stability in the denture.<sup>6</sup> The LO concept can result in a reduction in lateral force and produce more controlled chewing force in patients.<sup>3,6</sup> The LO concept can be used as an alternative to the BBO concept, which is known as the ideal concept of a conventional complete denture but is difficult to achieve clinically and requires a long time for operators to master.<sup>20</sup> The tooth arrangement of a complete denture with the LO concept is shown in Figure 2.



**Figure 2.** Dental Arrangement with the Concept of Lingualized Occlusion<sup>29</sup>

Canine guided occlusion was introduced by d'Amico in 1958 and adopted by the school of Gnatology to replace Balanced Occlusion in natural teeth.<sup>31</sup> The 2 mm inter-jaw disocclusion space during eccentric movement is shown in figure 3. The advantages of a CGO full denture are that it is simpler to manufacture, improves comfort when chewing food, and is more stable than BBO.<sup>32</sup> According to research conducted by Grubwieser et al. and Gausch showed that muscle activity is reduced, but masticatory efficiency is increased with a full denture with a CGO occlusion concept.<sup>14</sup> CGO is more recommended

for use as an occlusal concept in excursive movements. However, this concept often causes disocclusion resulting in thrush in patients only in the initial week and gradually improves.<sup>33</sup>



**Figure 3.** Disocclusion space between jaws by 2 mm during eccentric movement<sup>32</sup>

## Conclusion

All occlusion concepts give good results when used according to the patient's condition. If the patient has a normal lateral condition and does not have parafunctional habits, balanced occlusion is recommended as it does not affect the masticatory function of the complete denture. The concept of lingualized occlusion results in a decrease in lateral force so this concept is very suitable for use in patients who have severe alveolar bone resorption. The use of the canine guided occlusion occlusal scheme has an effect on masticatory function, namely minimal muscle activity but does not reduce masticatory function based on objective and subjective research. CGO is preferred because the manufacturing process will not take much time, and the mastication performance is good and the manufacturing is easier and simpler.

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**Table 2.** List of articles

No.	Articles	Researcher	Analysis of bias	Type of studies	Participants	Intervention	Outcome	Setting
1.	<i>Patient ratings of chewing ability from a randomised crossover trial: lingualised vs. first premolar/canine-guided occlusion for complete dentures</i>	Heydecke et al.	<i>Low risk</i>	RCT	20 edentulous patients	LO, BBO	Masticatory efficiency in BBO better than LO	Wearing complete denture for 3 and 6 months
2.	<i>Masticatory efficiency in denture wearers with bilateral balanced occlusion and canine guidance</i>	Farias et al.	<i>Low risk</i>	RCT	24 edentulous patients	CGO, BBO	CGO is more recommended as an occlusal concept for excursive movement. It enhances overall patient satisfaction by providing dentures with superior esthetics, chewing efficiency, and comfort	Wearing complete denture for 3 months
3.	<i>Patient satisfaction with occlusal scheme of conventional complete dentures: a randomized clinical trial (part I)</i>	Moradpoor et al.	<i>Low risk</i>	RCT	86 edentulous patients	BBO, LO, BO	The BBO stability value remained consistent throughout the examination. However, the BBO caused discomfort during chewing	Wearing complete denture for 3 months
4.	<i>A cross-over randomized clinical trial of eccentric occlusion in complete denture</i>	Paleari et al.	<i>Low risk</i>	RCT	44 edentulous patients	BBO, CG	Retention, chewing ability, esthetics, and mandibular movements during chewing in CG are	Wearing complete denture for 1 months



							comparable to those in BBO	
5.	<i>Influence of guidance concept in complete dentures on oral health related quality of life – canine guidance vs bilateral balanced occlusion</i>	Schierz et al.	Low risk	RCT	19 edentulous patients	CGO, BBO	No significant differences are observed between CGO and BBO	Wearing complete denture for 3 months
6.	<i>The Influence of occlusion on masticatory performance and satisfaction in complete denture wearers</i>	Deniz et al.	Low risk	RCT	30 edentulous patients	LO, BBO	EMG activity of the masticatory muscles is significantly higher with the LO concept compared to the BBO concept	Wearing complete denture for 3 and 6 months
7.	<i>Comparisons of patient satisfaction levels with complete dentures of different occlusions: a randomized clinical trial</i>	Shirani et al.	Low risk	RCT	15 edentulous patients	LO, BBO	The use of the LO concept is more comfortable than the BBO concept	Wearing complete denture for 1,5 months
8.	<i>Prospective clinical study of bilateral balanced occlusion (BBO) versus canine-guided occlusion (CGO) in complete denture wearers</i>	Brandt et al.	Low risk	RCT	40 edentulous patients	CGO, BBO	Retention, mastication, phonetics, and esthetics of CGO are better than BBO	Wearing complete denture for 3 months
9.	<i>Masticatory function in complete denture wearers varying degree of mandibular bone resorption and occlusion concept: canine-guided occlusion versus bilateral</i>	Pero et al.	Low risk	RCT	40 edentulous patients	CGO, BBO	According to patient reports, CGO demonstrates superior chewing ability (bread, raw carrots, beef) and higher bite force compared to BBO	Wearing complete denture for 1 months



<i>balanced occlusion in a cross-over trial</i>								
10.	<i>Influence of mandibular residual ridge resorption on objective masticatory measures of lingualized and fully bilateral balanced denture articulation</i>	Matsumaru dkk	<i>Low risk</i>	RCT	22 edentulous patients	LO, BBO	LO is preferred occlusion concept for patients with severe residual ridge resorption (RRR)	Wearing complete denture for 3 and 6 months
11.	<i>A double blind randomized clinical trial comparing lingualized and fully bilateral balanced posterior occlusion for conventional complete dentures</i>	Kawai dkk	<i>Low risk</i>	RCT	60 edentulous patients	LO, BBO	The LO concept is more efficient for patients with severe alveolar ridge resorption	Wearing complete denture for 6 months
12.	<i>Masticatory efficiency in complete denture and single implant retained mandibular overdenture wearers with different occlusion schemes: a randomized clinical trial</i>	Rocha dkk	<i>Low risk</i>	RCT	30 edentulous patients	LO, BBO	There is no difference in masticatory efficiency with the BBO and LO	Wearing complete denture for 1 months
13.	<i>RCT comparing posterior occlusal forms for complete dentures</i>	Sutton dkk	<i>Low risk</i>	RCT	45 edentulous patients	LO, BBO, zero degree	The use of LO and BBO demonstrates superior masticatory ability compared to the zero-degree concept	Wearing complete denture for 1 months