

# OCCLUSION IN NEWLY FABRICATED BRIDGE\*

(OKLUSI PADA GIGI TIRUAN JEMBATAN YANG BARU DIBUAT)

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## Abstract

Fabrication of prostheses must be planned and designed to fit harmoniously with the complexity of the neuromuscular system of the patient, the temporomandibular joints and supporting structures of the teeth. Any occlusal interference from the prostheses would invade the systems and caused various problems to the patient. The aim of this study was to evaluate the occlusion of 3-unit conventional bridges prior to cementation. All bridges that scheduled for cementation was noted. Before the occlusal examination was performed, the retainers were examined to ensure good marginal fit and have adequate interproximal contact with adjacent teeth. Occlusal examination was performed using articulating foil with the thickness of 8µm, Miller's forceps and thickness gauge. From 33 bridges identified, 93.9% were qualified for occlusal examination. Most of the retainers and pontics showed multiple high spots. From 62 retainers and 31 pontics, 213 occlusal contacts were obtained, with 25.8% on cuspal inclinations, 24.4% presented with high spots on marginal ridges and 11.7% on cuspal tips. The thickness of the high spots ranges from 0.5-3.6mm. High occlusion could be resulted from various factors such as inadequate tooth preparation and lack on the usage of semiaadjustable articulator. Occlusal examination has to be performed prior to bridge cementation to ensure comfort during functioning and health of the hard and soft tissues.

**Key words:** occlusion, occlusal interference, occlusal contact, occlusal adjustment, conventional bridge

## INTRODUCTION

Occlusion, as defined in The Glossary of Prosthodontics Terms, is the act or process of closure or of being closed or shut off.<sup>1</sup> It can also be defined as the static relationship between the incising or masticating surfaces of the maxillary or mandibular teeth or tooth analogues.<sup>1</sup> All restorations, as well as the fabrication of prostheses must be planned and designed to fit harmoniously with the complexity of the neuromuscular system of the patient, the temporomandibular joints and supporting structures of the teeth. Any occlusal interference from the restorations or prostheses would invade the systems and caused various problems to the patient. The aim of any restorations is a stable occlusal contact with smooth and uninterrupted protrusive and lateral movements of the mandible.<sup>2-4</sup> In order to achieve the above aim, the morphology of the occlusal surfaces of the restored teeth must be acceptably perfect as it would influence the guidance of the mandible.

The first step of treatment planning is to decide whether to reorganize or to conform the existing occlusion. In conformative approach, the existing occlusion is maintained, and the restorations or prostheses would follow the existing occlusal scheme. Moreover, conformative approaching usually is being done if only small number of teeth were restored. On the other hand, in reorganized approach, the occlusal scheme is deliberately changed to a new and stable position, usually to the retruded contact position that may involve a change to the occlusal vertical dimension.<sup>2,5-9</sup> Planning of reorganized approach must be very careful and it requires a high level skill and knowledge from both technician and clinician to ensure a good clinical result. It is usually involved in the restorations of large number of teeth or in case of full mouth rehabilitation. Examination and assessment of the occlusion have to be performed before any prosthodontic treatment. Centric occlusion as well as centric relation have to be identified. There are few techniques that are available in determining the relationship of the jaws.<sup>3,9-10</sup>

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In any case of occlusal interferences during mandibular movement, occlusal adjustment may be required before any restorative procedures are started.<sup>2</sup> Selective occlusal adjustment is indicated in the case of over eruption of the opposing tooth, tilted teeth that caused uneven occlusal plane and in any interferences that present during protrusion and lateral movements of the mandible. After the occlusion is stable, restorative procedures could be preceded with care not to introduce any iatrogenic interference. A literature review published in 2003 concluded that iatrogenic occlusal contact relations that interfere with function should be avoided as it has significance in the adaptive level of masticatory system including the temporomandibular joints.<sup>11</sup> Occlusal adjustment has to be performed if this interference presents on the restoration. A simple technique for occlusal adjustment is to use articulating paper or foil to mark the occlusal surface of the tooth that indicates any interferences, and the spot is being removed with high-speed handpiece.

In the construction of fixed prostheses, occlusal adjustment is always necessary before cementation of the prostheses. There are many factors that can contribute to the occlusal interference, such as inadequate occlusal reduction of the tooth preparation and poor interocclusal records that will lead to inaccuracies mounting of the working casts.<sup>12-13</sup> It would be very ashame if dental practitioner spent chairside time to adjust the occlusal interference on the prostheses after careful examination and planning.

During the try-in and cementation of fixed prostheses stage, the prostheses have to be seated accurately on the preparation before dental practitioner performs any occlusal examination. Margins of the crown must have an accurate fit, with not too tight of proximal contacts and the crown must be retentive. When the crown is fully seated, examination of the occlusion with articulating foils and shim stocks must be performed. In confomative approach, the occlusion before the crown is in placed must be similar with the occlusion when the crown is seated intraorally. Articulating foils and shim stocks were made to evaluate the occlusion precisely as it is only 8µm thick.<sup>14</sup> Both restoration and adjacent teeth should hold shim stock firmly in the maximum intercuspation. The occlusal adjustment could be performed using diamond bur with care not to perforate the crown. The thickness of the adjusted area could be measured with a gauge thickness. The crown should be free from high occlusal contact and interferences from mandibular movements. Failure to provide smooth and uninterrupted protrusive and lateral movements could result in

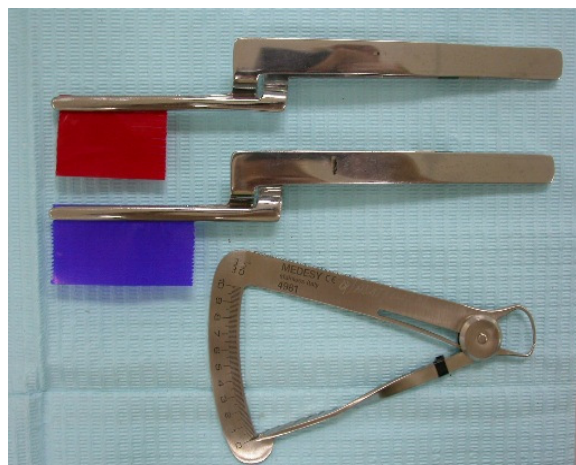
decementation or fracture of the prostheses. Failure in achieving occlusal harmony in maximum intercuspation would result in the crowned tooth is being overloaded which in turned can cause pain and mobility.<sup>14</sup>

The aim of this present study is to evaluate the occlusion of 3-unit conventional bridges prior to its cementation.

## MATERIALS AND METHODS

A pilot study was conducted from September 2007 until December 2007 to evaluate the occlusion of 3-unit conventional bridges prior to its cementation. All 3-unit conventional bridges that scheduled for cementation with conformative approach were noted. The occlusal or incisal surface was evaluated for its anatomy and morphology. Before the occlusal examination was performed, the prostheses must be adjusted, if necessary, to ensure good marginal fit and has adequate interproximal contact with adjacent teeth. Fit Checker (GC, Japan) was used to ensure marginal fit of the prostheses, and articulating foil (Bausch Inc., Germany) was used to check interproximal contact. The prostheses must be retentive and stable without evidence of rocking. Once the prosthesis was fully seated, an occlusal examination was performed using articulating foil (Bausch Inc., Germany) with the thickness of 8µm using Miller's forceps (Hu-Friedy, Germany) and gauge thickness (Medesy, Italy) (Figure 1). Patient was asked to bite on the articulating foil (Bausch Inc., Germany) in maximum intercuspation position. The prostheses were then removed and the occlusal or incisal surface was examined for any contact with the opposing tooth or teeth. The locations of the occlusal contact (before any adjustments) were identified and the thickness of the prostheses at the contacts was measured with gauge thickness (Medesy, Italy). To reduce the introduction of errors related to the measuring procedure, all measurements were done by same examiner, and the measurements were repeated three times at the same location. The average of the readings was utilized for further statistical analysis. Once the occlusal adjustment was completed, the prostheses were then evaluated for its acceptability to cementation.

All data were analyzed using Statistical Package for the Social Sciences (SPSS) version 12.0 (SPSS Inc., USA). Data collected were presented with descriptive statistics and frequencies of analyses.



**Figure 1.** Armamentarium for occlusal examination; articulating foil with Miller's forceps and gauge thickness

## RESULTS

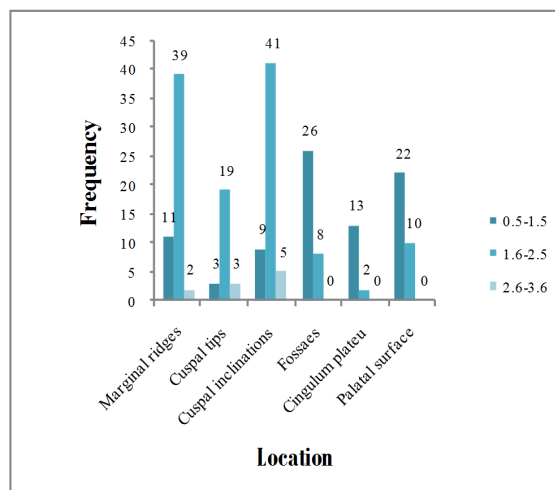
Within the period of three months, thirty three 3-unit bridges were identified. These include the bridges done by dental undergraduates, general dental practitioners and dental specialists. The distribution of sample was shown in Table 1.

**Table 1.** Distribution of sample showed types of bridge fabricated and teeth involved

Types of bridge	Number of sample (n)	Percentage (%)
Maxillary anterior porcelain fused to metal crowns	7	21.2
Maxillary posterior porcelain fused to metal crowns	6	18.2
Mandibular posterior porcelain fused to metal crowns	7	21.2
Mandibular posterior full metal crowns	3	9.1
Maxillary posterior combination porcelain fused to metal and full metal crowns	3	9.1
Mandibular posterior combination porcelain fused to metal and full metal crowns	7	21.2
<b>Total</b>	<b>33</b>	<b>100</b>

All samples showed acceptable anatomy and morphology, palatally, incisally and occlusally. Majority of retainers was adjusted appropriately to achieve acceptable marginal fit and adequate inter-

proximal contact. Two of the retainers were unacceptable as marginal defect was present after adjustment, resulted in 31 (93.3%) sample qualified for occlusal examination. Figure 2 showed the average thickness of occlusal contact and the location. Table 2 showed the total contacts for each location.



**Figure 2.** Average thickness of occlusal contact and the location of the occlusal interference

**Table 2.** Total contacts measured

Contacts	Thickness (mm)			Total
	0.5-1.5	1.6-2.5	2.6-3.6	
Marginal ridges	11	39	2	52
Cuspal tips	3	19	3	25
Cuspal inclinations	9	41	5	55
Fossae	26	8	0	34
Cingulum plateau	13	2	0	15
Palatal surface	22	10	0	32
<b>Total</b>	<b>84</b>	<b>119</b>	<b>10</b>	<b>213</b>

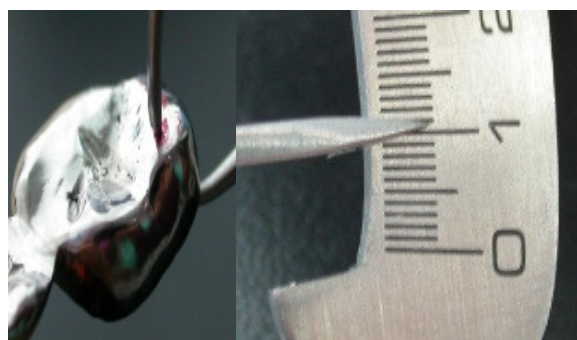
Cuspal inclinations showed majority of occlusal contacts with 25.8% contacts. Most of the posterior bridge units presented with thick cuspal inclinations (83.6%) and marginal ridges (78.8%), and these were the areas of occlusal interferences. The thickness ranges from 1.6-3.6mm. Occlusal contact was evident on fossae, which showed the thickness of 0.5-1.5mm in 12.7% contacts. As for anterior bridge unit, 10.3% occlusal contacts were in the range of 0.5-1.5mm thickness, while 4.7% contacts in the thickness of 1.6-2.5mm palatally. Occlusal contacts were also evident at cingulum plateau, with 6.1% contacts the thickness of 0.5-1.5mm and 0.9% 1.6-2.5mm. Figure 2 to 4 showed the examples were assessed during occlusal examination.



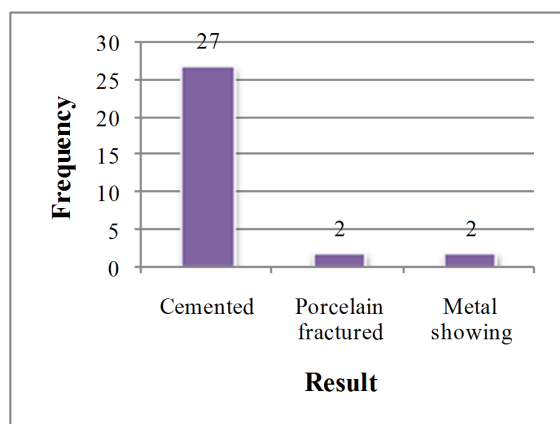
**Figure 3.** Three-unit conventional bridges with porcelain occlusion, evidence of major occlusal adjustments that lead to perforation of metal on occlusal surface of the distal retainer



**Figure 4.** Three-unit conventional bridges with metal occlusion, evidence of initial occlusal contacts on cuspal tip of mesial retainer and marginal ridge of distal retainer



**Figure 5.** Thickness of one initial contact, on marginal ridge of the retainer, measured 1.1mm on the gauge thickness



**Figure 6.** Results after occlusal adjustment

Out of 31 bridges that underwent occlusal adjustment, only 27 were acceptable for cementation, resulted in 87.1% of success the rate for cementation. 4 bridges had to be remade due to several reasons (Figure 5).

## DISCUSSIONS

Patient must not feel any discomfort or pain after the cementation of any fixed prostheses. To ensure patient could function comfortably, occlusal examination has to be performed prior to its cementation of the prostheses apart from other assessment and examination. In confirmative approach, the occlusion of patient with the prosthesis seated intraorally must be coinciding with the occlusion without the prosthesis, or with the existing occlusion. It must also free from any interferences during mandibular movements. This would ensure comfort during functioning and health of the hard and soft tissues. Furthermore, any adjustment made must be performed after perfect seat of the prostheses.

In this present study, thirty three 3-unit bridges that fabricated according to conformance approach were identified. Two of the samples were not qualified for occlusal examination as they presented with marginal defect that could not be corrected. Marginal fit is one of the principles of preparation and it is important to identify any defect, including open margin, positive ledge or negative ledge prior to occlusal adjustment.

Thirty-one bridges qualified for occlusal examination and became sample, counted for 62 retainers and 31 pontics. Maxillary anterior porcelain-fused to metal (PFM) crown, mandibular posterior PFM crown and mandibular combination of PFM and full metal crown were mostly evaluated in this study. Initial occlusal contacts were measured with the use of articulating foil and gauge thickness. It was found that the thickness of occlusal contacts varied depending on the location of the surface.

Occlusal adjustment may lead to unacceptable prosthesis. In this study, from 31 bridges that underwent occlusal adjustment, only 27 bridges acceptable for cementation. Porcelain had fractured in two of the bridges after occlusal adjustment, while the other two bridges showed metal showing in the esthetical area after the adjustment.

Almost all of the prostheses evaluated for this study presented with high occlusal contact. This may be due to several factors: inappropriate treatment plan; inadequate tooth preparation; too bulky occlusal or incisal surface with inappropriate morphology; inadequate working impression, as well as working cast; Inaccurate opposing cast; lack usage

of semiadjustable articulator; prosthesis being fabricated without mounting with the opposing cast; dental operator did not send the opposing cast to the dental technician; inaccurate bite record provided by the dental operator; and inaccurate mounting of the casts.

Treatment planning for the construction of fixed prostheses or any other prostheses is mandatory. Inappropriate planning would lead to many problems and may risk the health of soft and hard tissues. Occlusal analysis should be performed during the examination and diagnosis stage to formulate the appropriate treatment plan. It could prevent the fabricated prostheses to have short life. Crown or bridge that being cemented not according to the appropriate occlusion would result in the affected teeth to become painful because of increased load, and some of these teeth may crack under the added load.<sup>15</sup>

It has been suggested that alginate impression of the opposing arch has to be casted in stone rather than plaster as it would provide strength and high wear resistance of the cast.<sup>13</sup> Alginate impression of the opposing arch can be a problem as casting of the impression would lead to inaccuracies such as bubbles produced on the cast. A liquid surfactant can be sprayed on the alginate surface to reduce the tension of the impression material before casting that would prevent air bubbles on the surface of the cast.<sup>13</sup>

Bite record should only be taken for posterior teeth and should be trimmed before using them for mounting. This would eliminate the unwanted material that touches soft tissues in oral cavity that extends into undercuts or extends more to adjacent teeth beyond the prepared teeth.<sup>13</sup> Trimmed bite record would lead to accurate mounting of the casts, therefore it would lead to accurate occlusion.

Mounting of the casts must be performed as precisely as possible. Both casts must be stable and fit together. Both casts can be stabilized by sticky wax or rubber band that can be removed after the mounting procedure completed. Accurate mounting would reduce the adjustments needed chairside, provided that the bite record and the opposing cast are both accurate. Fabrication of any prosthesis without the opposing cast would lead to either under- or over-bulk of the occlusal surface.

Occlusal adjustment of the prosthesis performed at chairside would be disadvantageous to dental operator.

In certain cases where major occlusal adjustment has to be performed, check record technique is a worth trial. This is when the occlusion of patient with the prosthesis seated was recorded and the casts were remounted based on the new bite record. With this technique, the occlusal adjustment could be performed in the laboratory.

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