Relationship between occlusal schemes and temporomandibular disorders in Malaysian population

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Abstract

Aims: To evaluate the type of occlusal schemes and its relation to temporomandibular disorders and to compare their relation in different ethnic groups of Malaysia.

Methods: The population for this study consisted of 240 human subjects with the age ranges from 20-30 years. Through random sampling, subjects were divided into 3 groups. Group A: 80 human subjects of Chinese origin, Group B: 80 human subjects of Indian origin and, Group C: 80 human subjects of Malay origin. The static and dynamic occlusion of each subject was assessed by intraoral examination. Occlusion on laterotrusive movements was categorized into four groups: Group I: Canine guided occlusion on both the sides (CGB), Group II: Canine guided occlusion on Left side and Group function occlusion on Right side (CGL+GFR), Group III: Canine guided occlusion on Right side and Group function occlusion on Left side (CGR+GFL) and, Group IV: Group function occlusion on both the sides (GFB). The Research Diagnostic Criteria for Temporomandibular Disorders (RDC/TMD) Axis-I was used as a guideline in clinical examination procedures.

Results: Most prevalent occlusal scheme amongst all three races was found to be GFB occlusion with Malays predominance followed by Chinese and Indians with p value 0.001. TMD’s was found to be most prevalent in Chinese population followed by Malays and Indians with p value 0.028 and in GFB, followed by CGB, CGL+GFR and CGR+GFL occlusal schemes with p value 0.04.

Conclusion: GFB has an influence in developing TMD’s, but we could not find any significant difference in occlusion schemes and its relation with TMD’s amongst three racial groups studied. Further long term randomized clinical trials studies with larger sample size are required.

Keywords: occlusal schemes, temporomandibular disorders, group function occlusion, canine guided occlusion

Introduction

The Glossary of Prosthodontics term [1] (GPT-9) describes temporomandibular disorders (TMD’s) as, a condition producing abnormal, incomplete, or impaired function of the temporomandibular joint(s) and/or a collection of symptoms frequently observed in various combinations first described by Costen (1934, 1937), which he claimed to be reflexes due to irritation of the auriculotemporal and/or chorda tympanic nerves as they emerged from the tympanic plate caused by altered anatomical relations and derangements of the temporomandibular joint associated with loss of occlusal vertical dimension, loss of posterior tooth support, and/or other malocclusions; the symptoms can include headache about the vertex and occiput, tinnitus, pain about the ear, impaired hearing and pain about the tongue— acronym TMD’s.

The aetiology of TMD’s is multifactorial and may be classified as biomechanical, neuromuscular, biopsychosocial, and neurobiological factors [2]. Possible risks factors contribute to TMD’s are occlusal factors, parafunction (bruxism), trauma, hypermobility, stress, personality, age, gender, heredity and systemic diseases [3].

The very much controversial topic of debate in dentistry is, the role of occlusal factors in developing TMD’s and will have been the subject of an intense discussion within the dental community. The occlusal factors must be analyzed both in static and dynamic conditions. Several studies support the role of occlusal factors in static occlusion conditions like anterior cross bite [4], posterior cross bite [5], large horizontal or vertical overlap [6,7] anterior open bite [8], absence of five or more posterior teeth, edge to edge bite, Class II and III, the absence of effective anterior guide5, abnormal curve of Spee and Wilson [9] in developing TMD’s and there are also studies [10-12] which put less emphasis, the role of static occlusal factors in TMD’s. Dynamic occlusal factors like slide in centric [13-17], presence of mediotrusion interferences [18] and balancing side interferences5 support their role in developing TMD’s and there are studies [19] which does not support occlusal interferences as an aetiological factor in developing TMD’s.

Dynamic functional occlusion is categorized into two types in natural dentition, the canine-guided occlusion and the group function occlusion. The canine-guided occlusion [20] suggested by D’Amico, is also known as a canine-protecting occlusion is the disclusion by the canines of all other teeth in lateral excursions i.e. where when the mandible moves laterally only canines will be in contact on the working side while elsewhere and on the balancing side no contact is made.

On the other hand group function occlusion commonly known as unilateral balanced occlusion as suggested by Schuyler [21,22] is defined by the Glossary of Prosthodontic Terms as multiple contact
relations between maxillary and mandibular teeth in lateral movements on the working side whereby simultaneous contact of several teeth acts as a group to distribute occlusal forces [1].

In fact, canine guidance is considered the most physiologic of all occlusal relationships because it protects the teeth from wear and tends to prevent bruxism [23]. An occlusion in group function is more prone to perpetuate the bruxing habit leading to greater and greater wear on all teeth. Moses [24] suggested that physiological wear is natural, beneficial and inevitable.

The canine-guided occlusion and group function occlusal schemes are divergent in terms of philosophy and technique; and there is also little scientific evidence that supports one occlusal scheme over the other. However, since both occlusal schemes differ in the sense of how the occlusal forces are distributed, hence will affect the temporomandibular joint differently as well. Occlusal pattern in function is also not stable and varies with ethnic group [25]. Lipton et al [26], Widmalm et al [27] and Plesh et al [28] have conducted studies to evaluate the relationship between ethnicity and TMD's among African-Americans and non-Hispanic Caucasians but such studies have not been done among Asians.

This present study has been undertaken to evaluate the type of occlusal schemes and its relation to TMD's and to compare their relation in different ethnic groups in Malaysia.

Materials and methods

The present study was conducted in faculty of dentistry, AIMST Dental Centre, AIMST University, Malaysia following the ethical committee clearance and informed consent from the subjects. The population for this study consisted of 240 human subjects with the age ranges from 20-30 years. Through random sampling, subjects were divided into 3 groups.

Group A: 80 human subjects of Chinese origin
Group B: 80 human subjects of Indian origin
Group C: 80 human subjects of Malay origin

Subjects who meet the following criteria are selected:

1. The presence of a full permanent dentition except for the third molars.
2. No previous or current orthodontic treatment and no previous occlusal adjustments.
3. No large restorations involving the incisal edge or a cusp tips and no crowns or bridges.
4. No apparent pathologic periodontal problems and no extractions done previously.
5. Upper and lower canines in the line of the arch and no tooth showing attrition into the dentine.

Method for determining occlusal schemes

The static and dynamic occlusion of each subject is assessed by intraoral examination on a dental chair under direct vision and with the aid of 8 mm width, 8 micrometer thickness (Almore shimstock, Hanel, Langenau, Germany) to confirm tooth contact. The following static occlusal features are recorded:

- Incisor relationship classified according to the British Standard Institute [29]
- Canine relationship classified according to Houston et al [30]
- Molar relationship classified according to Angle’s criteria [29]

To make it convenient, occlusion on laterotrusive movements is categorized into four groups:

Group I: Canine guided occlusion on both the sides (CGB)
Group II: Canine guided occlusion on Left side and Group function occlusion on Right side (CGL+GFR)
Group III: Canine guided occlusion on Right side and Group function occlusion on Left side (CGR+GFL)
Group IV: Group function occlusion on both the sides (GFB)

Method of evaluation of temporomandibular disorders

The patient was enquired about the medical history, headache, limitation of mouth opening, pain, discomfort, noise and trauma in TMJ. The Research Diagnostic Criteria for Temporomandibular Disorders (RDC/TMD) [31] Axis I was used as a guideline in clinical examination procedures. In addition to standardization of TMD clinical diagnosis procedure, RDC/TMD facilitates the good intra and inter-examiner reliability.

All the observations were recorded and results were tabulated. Following the tabulations of the data, all the analysis were done using SPSS software version 18. A p-value of <0.05 was considered statistically significant. Comparison of categorical variables was done using Chi-Square test. All the findings were compiled and tabulated; following results were obtained after statistical analysis as presented below.

Results

Table 1 and graph 1 represents, most prevalent occlusal scheme amongst all three races is GFB occlusion with 46(57.5%) Malay, 40 (50.5%) Chinese, and 29(36.3%) Indian subjects. The second most prevalent occlusal scheme amongst all three races is CGB occlusion which shows 31(38.8%), 28(35.0%), and 19(23.8%) subjects respectively. CGR+GFL occlusal scheme amongst all three races is 3(3.8%), 6(7.5%) and 16(20%) subjects and CGL+GFR occlusal scheme are as 0(0%), 6(7.5%) and 16(20%) respectively.

<table>
<thead>
<tr>
<th>RACE</th>
<th>Malay</th>
<th>%</th>
<th>Chinese</th>
<th>%</th>
<th>Indian</th>
<th>%</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>CGB</td>
<td>31</td>
<td>38.80%</td>
<td>28</td>
<td>35.00%</td>
<td>19</td>
<td>23.80%</td>
<td>&lt;0.001; Sig</td>
</tr>
<tr>
<td>CGL+GFR</td>
<td>0</td>
<td>0.00%</td>
<td>6</td>
<td>7.50%</td>
<td>16</td>
<td>20.00%</td>
<td></td>
</tr>
<tr>
<td>CGR+GFL</td>
<td>3</td>
<td>3.80%</td>
<td>6</td>
<td>7.50%</td>
<td>16</td>
<td>20.00%</td>
<td></td>
</tr>
<tr>
<td>GFB</td>
<td>46</td>
<td>57.50%</td>
<td>40</td>
<td>50.00%</td>
<td>29</td>
<td>36.30%</td>
<td></td>
</tr>
</tbody>
</table>

Table 1: Prevalence of types of occlusal schemes amongst Malay, Chinese and Indian population
Table 2 and graph 2 represents the prevalence of TMD's amongst 80 Malay, 80 Chinese, and 80 Indian human subjects which shows that TMD's is most prevalent amongst the Chinese subjects with 31 (38.8%) subjects being diagnosed with a TMD's followed by Malay with 21 (26.3%) subjects and followed by Indians with only 16 (20%) subjects.

The table 3 and graph 3 represents the comparison of the prevalence of TMD's within different occlusal schemes. The x-axis represents the prevalence of TMD's while the y-axis represents the type of occlusal scheme and shows that TMD's is most prevalent in GFB with 40 (58.8%) subjects, followed by CGB with 13 (19.1%) subjects. In CGL+GFR and CGR+GFL occlusal schemes shows 8 (11.8%) and 7 (10.3%) subjects respectively. It shows significant difference (p=0.04) when compare TMD's with different occlusal schemes.

Table 4 represents, out of 240 subjects only 68 subjects showed positive TMD's in which 21, 31 and 16 human subjects belong to Malay, Chinese and Indian races respectively. This shows prevalence of TMD's is more in Chinese in comparison with other two racial groups. Out of 21 subjects in Malay group with TMD's includes 18 (85.7%) subjects, out of 31 subjects in Chinese with TMD's includes 23 (74.2%) and out of 16 subjects in Indian with TMD's includes 5 (31.3%), showed GFB occlusal scheme which shows prevalence of TMD's is more in GFB occlusal scheme when compare with other remaining types of occlusion schemes Table 5.

Out of 240 subjects in entire pool, only 68 subjects showed TMD's among which 42 (61.8%) subjects showed Type 2A TMD's. Table 6 represents GFB type of occlusal scheme showed the highest prevalence of canine attrition when compare with other occlusal schemes Graph 4a-4c-6.

<table>
<thead>
<tr>
<th>Race</th>
<th>OCCLUSAL SCHEME</th>
<th>TMD's</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Malay</td>
<td>CGB</td>
<td>13</td>
<td>19.10%</td>
</tr>
<tr>
<td></td>
<td>CGL+GFR</td>
<td>8</td>
<td>11.80%</td>
</tr>
<tr>
<td></td>
<td>CGR+GFL</td>
<td>7</td>
<td>10.30%</td>
</tr>
<tr>
<td></td>
<td>GFB</td>
<td>40</td>
<td>58.80%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Race</th>
<th>Occlusal scheme</th>
<th>TMD's</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Malay</td>
<td>CGB</td>
<td>3</td>
<td>14.30%</td>
</tr>
<tr>
<td></td>
<td>CGL+GFR</td>
<td>0</td>
<td>0.00%</td>
</tr>
<tr>
<td></td>
<td>CGR+GFL</td>
<td>0</td>
<td>0.00%</td>
</tr>
<tr>
<td></td>
<td>GFB</td>
<td>18</td>
<td>85.70%</td>
</tr>
<tr>
<td>Chinese</td>
<td>CGB</td>
<td>7</td>
<td>22.60%</td>
</tr>
<tr>
<td></td>
<td>CGL+GFR</td>
<td>5</td>
<td>16.10%</td>
</tr>
<tr>
<td></td>
<td>CGR+GFL</td>
<td>2</td>
<td>6.50%</td>
</tr>
<tr>
<td></td>
<td>GFB</td>
<td>17</td>
<td>54.80%</td>
</tr>
<tr>
<td>Indian</td>
<td>CGB</td>
<td>3</td>
<td>18.80%</td>
</tr>
<tr>
<td></td>
<td>CGL+GFR</td>
<td>3</td>
<td>18.80%</td>
</tr>
<tr>
<td></td>
<td>CGR+GFL</td>
<td>5</td>
<td>31.30%</td>
</tr>
<tr>
<td></td>
<td>GFB</td>
<td>5</td>
<td>31.30%</td>
</tr>
</tbody>
</table>

Table 4: Evaluation of type of occlusal schemes and its relation to TMD's in different ethnic groups

Table 5: Prevalence of TMD's in different occlusal schemes

Table 6: GFB type of occlusal scheme showed the highest prevalence of canine attrition when compare with other occlusal schemes Graph 4a-4c-6.
Table 5: Prevalence of types of TMD’s existing in entire pool of population

<table>
<thead>
<tr>
<th>TMD’s type</th>
<th>N</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>1A</td>
<td>7</td>
<td>10.30%</td>
</tr>
<tr>
<td>1B</td>
<td>4</td>
<td>5.90%</td>
</tr>
<tr>
<td>2A</td>
<td>42</td>
<td>61.80%</td>
</tr>
<tr>
<td>2B</td>
<td>1</td>
<td>1.50%</td>
</tr>
<tr>
<td>2C</td>
<td>3</td>
<td>4.40%</td>
</tr>
<tr>
<td>3A</td>
<td>0</td>
<td>0.00%</td>
</tr>
<tr>
<td>3B</td>
<td>0</td>
<td>0.00%</td>
</tr>
<tr>
<td>3C</td>
<td>0</td>
<td>0.00%</td>
</tr>
<tr>
<td>2 or more TMD’s</td>
<td>11</td>
<td>16.20%</td>
</tr>
</tbody>
</table>

Table 6: Prevalence of canine attrition in different types of occlusion schemes

<table>
<thead>
<tr>
<th>OCCLUSAL SCHEME</th>
<th>CANINE ATTRITION</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Yes</td>
<td>N</td>
</tr>
<tr>
<td>CGB</td>
<td>62</td>
<td>41.10%</td>
</tr>
<tr>
<td>CGL+GFR</td>
<td>8</td>
<td>5.30%</td>
</tr>
<tr>
<td>CGR+GFL</td>
<td>18</td>
<td>11.90%</td>
</tr>
<tr>
<td>GFB</td>
<td>63</td>
<td>41.70%</td>
</tr>
</tbody>
</table>

Graph 2: Prevalence of TMD’s amongst Malay, Chinese and Indian population
Graph 3: Prevalence of TMD's in different types of occlusion scheme

Graph 4(a): Evaluation of type of occlusal schemes and its relation to TMD's in Malay ethnic group

Graph 4(b): Evaluation of type of occlusal schemes and its relation to TMD's in Chinese ethnic group
Graph (4c): Evaluation of type of occlusal schemes and its relation to TMD's in Indian ethnic group

Graph 5: Prevalence of types of TMD's existing in entire pool of population
Discussion

The process of mastication is guarded by three factors; teeth in contact, surrounding oral musculature and the temporomandibular joint. The successful rehabilitation of full mouth reconstruction depends upon biological harmony between these factors and any disorders with respect to these factors, TMD’s are the hardest to diagnose and treat. Considering how masticatory forces is the product of the unity between occlusal forces, surrounding oral musculature and the temporomandibular joint movement, there is no doubt that occlusion has a direct influence on the temporomandibular joint. Both canine guidance and group-function guidance occlusions are considered normal. The latter occlusal scheme occurs naturally as a result of occlusal wear [32].

The result from the present study showed that, GFB occlusion is the most prevalent occlusal scheme amongst all Chinese, Malay and Indian races which shows statically significant difference (chi square test, p<0.001) in the types of occlusion schemes with the racial groups. This is similar to the earlier epidemiological data such as study by Beyron [33], showed fairly overwhelmingly that adult Australian aborigines had group function occlusion, Weinberg [34] found that 81% of his studied population possessed group function occlusal scheme, whereas only 5% had canine guided occlusal scheme and Asawaworakit et al [35] in 2011 in his study on Thai population also found that majority of population (68.3%) possessed group function occlusion scheme. Study done by Shah et al [36] in which tooth wear found to be more in group function occlusion when compare with canine guided occlusion and contradict the study done by Meng et al [37] in 2014 on patients of a dental school's prosthodontics department in Xi'an, China. found that occlusal tooth wear index (OTWI) scores were not associated with occlusal guidance scheme.

The result of the present study shows that there is a significant difference among the three racial groups and their prevalence of TMD's which correlates with the survey study conducted by Hongxing et al [38] in 2016 in which they have found that Chinese group had 14.8% of TMD pain when compare with 5.1% in Swedish adolescent (p<0.0001). The relationship between TMD’s with GFB found to be more when compared with other occlusion schemes, this clinical results correlate with the study done by Sugiaman et al [39] in which they have found that group function occlusion causes TMD’s in 33.1% of population, when compared with other occlusion scheme studied and contradict the study done by Chisnou et al [9], according to which the type of guidance in propulsion or lateral movements cannot be considered a risk factor for the TMD’s appearance.

In the present study, only 68 human subjects out of 240 having TMD’s, this clinical result is comparable with the study done by Dworkin [40], that TMD’s may affect up to third of the population ranging from 5-50%. Most of the population group in this present study, having category 2 TMD’s (67.7%), followed by category 1 (16.2%) and category 3(0%) and 16.2% of population shows 2 or more TMD’s. But the study done by Landi et al [41] suggests that most disturbing feature in temporomandibular joint disorder is pain, followed by restricted mandibular movement, which can cause difficulty eating or speaking, and noises from the temporomandibular joint during jaw movement.

The rate of canine attrition is found to be more in GFB when compare with other occlusal schemes and there is statistically significant difference among them with p<0.001. It may be attributed to the fact that eating of coarse and abrasive foods in modern population where tooth wears adversely. Studies done by Shaw et al [42] and Butler et al [43] found that canine wear in modern humans because of the same reason. Food and the culture of eating of the Malaysian urban society have undergone some form of transformation [44]. A comparative study on intake of food habits in three ethnic groups in Malaysia on younger generation below 30 years of age was carried out and comparison was made on their consumption of traditional and fast food and it was found that in terms of selection of dishes, there were significant differences among ethnic groups [45]. So, it can be suggested that the eating habits in Malaysian culture may cause tooth wear and thereby change in occlusion scheme.

Conclusion

GFB has an influence in developing TMD’s, but we could not find any significant difference in occlusion schemes and its relation with TMD’s amongst three racial groups studied. Further long term studies with larger size sample are required.

References

which dental attrition in modern society is a function of age and of canine contact. J Orofac Pain 9: 266-275.