Orthodontic Treatment Need Assessed by Malocclusion Severity using the Dental Health Component of IOTN

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Abstract

The Dental Health Component (DHC) is part of the Index of Treatment Need, besides the aesthetic index, that is used to determine orthodontic treatment need. The DHC objectively assesses orthodontic treatment need using five assessment components: missing teeth, overjet, crossbite, displacement of contact point, and overbite including open bite (MOCDO). The results of MOCDO assessment are then used to determine the grade (grades 1–5) of orthodontic treatment needed based on the worst component.

We aimed to describe orthodontic treatment need based on malocclusion severity using DHC at the orthodontic specialist clinic RSKGM FKG UI from 2010 to 2014.

This study used 52 pre-treatment dental casts and used the five components (MOCDO from DHC) to determine the grade. Starting with the most common grade, patients' orthodontic treatment needs were 55.8% grade 4 (need for orthodontic treatment), 30.8% grade 3 (borderline need for orthodontic treatment), 9.6% grade 2 (little need for orthodontic treatment), and 3.8% grade 5 (great need for orthodontic treatment). There were no cases of grade 1, which describes patients with no orthodontic treatment need.

This study objectively concluded that most patients who visited the orthodontic specialist clinic had significant orthodontic treatment need (grades 4) and great need of orthodontic treatment (grade 5) was the least.

Introduction

Malocclusion is a common dental and oral health problem in Indonesia. The proportion of Indonesians who receive orthodontic treatment is much lower than the prevalence of occlusion.[4] The prevalence of malocclusion in Indonesia is estimated as 80%[1], but only 0.7% of them receive orthodontic treatment.[4] Thus, greater public awareness of malocclusion is needed to address this health problem and encourage people to seek orthodontic treatment.

In RSKGM FKG UI, there is more demand for orthodontic treatment at specialist clinics compared with undergraduate clinics that handle most cases of mild malocclusion. Orthodontic treatment is performed not only for cases of severe malocclusion but also for mild malocclusion as treatment can prevent malocclusion from becoming more severe. Treatments of this type are classified as interceptive orthodontic treatment. By contrast, curative care is performed in cases of moderate to severe malocclusion.[6]

Given this background of malocclusion in Indonesia, it is necessary to research the grade of orthodontic treatment needs in relation to the severity of malocclusion. The purpose of this study was to understand orthodontic treatment needs based on the severity of malocclusion using the Dental Health Component (DHC) from the Index Of Treatment Need (IOTN) by measuring missing teeth, overjet, crossbite, displacement of contact point and overbite/open bite (MODCO) in patients seeking orthodontic treatment. This study aimed to obtain a better

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picture of orthodontic treatment needs so that health care services can be better planned.

Materials and methods

This was an observational study with a cross-sectional design conducted in October 2017. The population comprised patients seeking treatment at the orthodontic clinic RSKGM FKG UI Salemba between 2010 and 2014. This study was approved by the Ethics Commission of the institution (99 /Ethical Approval /FKGUI/X/2/17).

The inclusion criteria were the maxillary and mandibullary pre-treatment study model should be in good intact and complete anatomical condition and good model base to provide proper occlusion. The 52 samples of study model was from the year 2010 to 2014 patients who had permanent dental period.

After Ethical approval, reliability test of MOCDO measurements was done both inter and intra examiner analized by using ICC test of SPSS version 21. Measurement of each subject was made using an iron ruler with a tip of 0 mm. The measurement results recorded in the collection data table were then adjusted to the DHC table, and the most severe result was used as the DHC score (Table 1). Subsequently, there was a classification of orthodontic treatment needs based on DHC (Table 2). Data processing was performed using Microsoft Excel 2016.

Alpha	Occlusal condition
a	Overjet – recorded to the most prominent part of the most prominent incisor
b	Reverse overjet with no masticatory or speech problems
c	Crossbite
d	Displacement of contact points where teeth deviate from the line of the arch, worst displacement recorded, spacing inline of the arch not included
e	Open bite
f	Deep bite
g	Good occlusion
h	Hypodontia
i	Impacted due to lack of space ≤4 mm
l	Posterior lingual crossbite
m	Reverse overjet with masticatory or speech problems
p	Defects of the cleft lip and palate
s	Submerged deciduous teeth
t	Partially erupted teeth, tipped and impacted against adjacent teeth
x	Presence of supernumerary teeth

Table 1. The category of Dental Health Component of Index Of Treatment Need.

Reliability of Assessment

At the beginning of the study, 10% of subjects (6) were used to assess inter-observer and intra-observer reliability. The inter-observer test was conducted between researchers and experienced experts as the gold standard. The results of the measurements by the two assessors were tested for reliability using the interclass correlation coefficient (ICC) test in SPSS version 24. The obtained value was 0.878, which means good agreement between the researchers. The intra-observer test was performed by the researcher with a 2-day interval between the first and second measurements. The results of both measurements were tested using the ICC test. The obtained value was 0.920, which means that the consistency of the researcher in making repeated measurements was very good.

Grade 1 – No orthodontic treatment required	
1	Extremely minor malocclusion, including displacements less than 1 mm
Grade 2 – Little need orthodontic treatment	
2.a	Increased Overjet greater than 3.5 mm but than or equal 6 mm (with competent lips)
2.b	Reverse overjet greater than 0 mm but than or equal 1mm
2.c	Anterior or posterior crossbite with than or equal 1mm discrepancy between retruded contact positon and intercuspal positon
2.d	Displacement of teeth greater than 1mm but less than or equal 2mm
2.e	Anterior or posterior open bite greater than 1mm but than or equal 2mm
2.f	Increased overbite greater than or equal 3.5mm (without gingival contact)
2.g	Pre-normal or post normal occlusions with no other anomalies. Includes up to half a unit discrepancy
Grade 3 (Borderline need orthodontic treatment)	
3a	Increased overjet greater than 3-5 mm, but less than or equal to 6 mm with incompetent lips
3b	Reversed overjet greater than 1 mm, but less than or equal to 3-5 mm
3c	Anterior or posterior cross bites with greater than 1 mm, but less than or equal to 2 mm discrepancy between retruded contact position and intercuspal position
3d	Contact point displacement greater than 2 mm, but less than or equal to 4 mm
3e	Lateral or anterior open bite greater than 2 mm, but less than or equal to 4 mm
3f	Deep overbite complete on gingival or palatal tissues, but no trauma
Grade 4 (Need orthodontic treatment)	
4h	Less extensive hypodontia requiring pre-restorative orthodontics or orthodontic space closure to obviate the need for prosthesis
4a	Increased overjet greater than 6 mm, but less than or equal to 9 mm
4b	Reversed overjet greater than 3-5 mm with no masticatory or speech difficulties

	Description
4m	Reverse overjet greater than 1 mm but less than 3-5 mm with recorded masticatory and speech difficulties
4c	Anterior or posterior cross bites with greater than 2 mm discrepancy between retruded contact position and intercuspal position
4l	Posterior lingual cross bite with no functional occlusal contact in one or booth buccal segments
4d	Severe contact point displacement greater than 4 mm
4e	Extreme lateral or anterior open bites greater than 4 mm
4f	Increased and complete overbite with gingival or palatal trauma
4t	Partially erupted teeth, tipped and impacted against adjacent teeth
4x	Presence of supernumerary teeth
Grade 5 (Great need orthodontic treatment)	
5i	Impeeded eruption of teeth (except for third molars) due to crowding, displacement, the presence of supernumerary teeth, retained deciduous teeth and any pathological cause
5h	Extensive hypodontia with restorative implications (more than 1 tooth missing in any quadrant) requiring pre-restorative orthodontics.
5a	Increased overjet greater than 9 mm
5m	Reverse overjet greater than 3-5 mm with reported masticatory and speech difficulties
5p	Defect of cleft lip and palate and other craniofacial anomalies
5s	Submerged deciduous teeth

Table 2. Orthodontic treatment need based on Dental Health Component of Index Of Treatment Need.

Results

Participants

Fifty-two patients were included in the analysis (46 females and 6 males). The distribution of subjects by year of producing the study model was 12 subjects in 2010; 15 subjects in 2011; 5 subjects in 2012; 11 subjects in 2013; and 8 subjects in 2014.

Treatment Needs

MOCDO was assessed for the 52 subjects. The majority of subjects (29 of 52) were grade 4 (need of orthodontic treatment); 15 were grade 3; 2 were grade 5 (great need of orthodontic treatment); 5 were grade 2; and none were grade 1 (no need for orthodontic treatment).

Total Missing Teeth	Gender			Total	
	Male	Female	N	Percentage (%)	
0	6	40	46	88.46	
1	0	2	2	3.85	
2	0	3	3	5.77	
4	0	1	1	1.92	
Total	6	46	52	100.00	

Table 3. Total missing teeth in research subjects by gender.

Overjet	Gender			Total	
	Male	Female	N	Percentage (%)	
>9 mm	1	1	2	3.85	
6.1–9 mm	2	2	4	7.69	
3.6–6 mm	1	18	19	36.54	
0–3.5 mm	1	24	25	48.08	
(−0.1)–(−1) mm	0	1	1	1.92	
(−1.1)–(−3.5) mm	1	0	1	9.62	
< −3.5 mm	0	0	0	0.00	
Total	6	46	52	100.00	

Table 4. Overjet of research subjects by gender.

Crossbite	Gender			Total	
	Male	Female	N	Percentage (%)	
0 mm	3	17	20	38.46	
<1 mm	0	11	11	21.15	
1.1–2 mm	2	12	14	26.92	
>2.1 mm	1	6	7	13.46	
Total	6	46	52	100.00	

Table 5. Crossbite of research subjects by gender.

Displacement of Contact Point	Gender			Total	
	Male	Female	N	Percentage (%)	
0	0	0	0	0.00	
<1 mm	0	0	0	0.00	
1.1–2 mm	1	8	9	17.31	
2.1–4 mm	4	18	22	42.31	
>4 mm	1	20	21	40.38	
Total	6	46	52	100.00	

Table 6. Displacement of contact point of research subjects by gender.

Overbite/open bite	Gender			Total	
	Male	Female	N	Percentage (%)	
>3.5 mm	3	14	17	32.69	
0 – 3.4 mm	3	19	32	61.54	
(−0.1) – (−1) mm	0	2	2	3.85	
(−1.1) – (−2) mm	0	1	1	1.92	
(−2.1) – (−4) mm	0	0	0	0.00	
> −3.5 mm	0	0	0	0.00	
Total	6	46	52	100.00	

Table 7. Overbite/open bite of research subjects by gender.

Discussion

This study used study models from the year 2010 to 2014 which were available in the Orthodontic Department in good condition. Meanwhile, the recent study models were not available yet because patients from recent year still undergo treatment. The study sample was taken by consecutive sampling, which was the selection of the research sample that was in accordance with the research criteria so that the sample was collected fulfill the required amount.
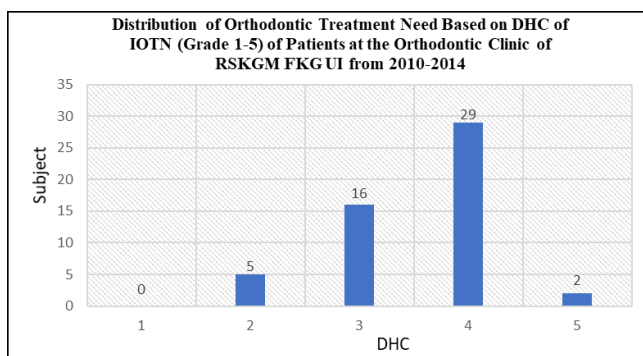
Figure 1. The number of subjects with orthodontic treatment needs by DHC.

The IOTN is an index consisting of two components, namely, the DHC and Aesthetic Component. In this study, DHC was selected because, in addition to considering the aesthetic problem, it was also required objective assessment in determining the needs and priorities of care. Components assessed by DHC include (1) missing teeth, (2) overjet, (3) crossbite, (4) displacement of contact point, and (5) overbite/open bite. These five components can be shortened to MOCDO. The level of orthodontic need is then determined by taking the most severe component on the basis of the DHC component table.[7–9]

The subjects in this study were mostly female (88.5%), which is consistent with the research by Riskesdas (2013) that found the recipients of most orthodontic treatment are women.[4] It also shows that more women attended the Orthodontic Clinic RSKGM FKG UI.

In the assessment of the first DHC component of the IOTN, a count of congenital tooth loss was performed. Of the subjects, six (11.54%) experienced congenital tooth loss and all were female. The assessment is in accordance with the work by Lamour et al. that reported the prevalence of congenital tooth loss to range from 2.6% to 11.3%. In the same article, it was stated that congenital tooth loss is more common in females.[10] Research conducted by Mani et al. in 837 children aged 12–16 years reported that 3.2% of children experienced congenital tooth loss other than third molars.[11]

The second DHC component of the IOTN measures the presence of overjet. In our study population, the distance of the anterior crossbite was found to be less than that of large or normal overjet. Anterior crossbites occurred in two subjects (3.85%), whereas large overjet was present in six subjects (11.54%). The comparison is in line with the research by Singh et al. that reported the rate of crossbites to be as high as 1.79% and that of overjet to be 17.51%.[12]

Crossbite measurements as the third DHC component of IOTN were performed on both the anterior and posterior teeth. The number of subjects with crossbites was as many as 32 (61.54%), whereas subjects without crossbites were 20 (38.46%). Compared with anterior crossbites in only two subjects (3.85%), many appeared to have posterior crossbites. In most cases, patients do not seek orthodontic treatment because of posterior tooth complaints; however, this needs to be reconsidered because posterior tooth complaints are associated with stomatognathic function that determines the health of tissues and joints. The crossbite comparison in this study is in line with that by Gungor et al. who reported permanent teeth with posterior crossbites in 64.3% of subjects and no crossbites in 35.7% of subjects.[14]

Measurement of contact point displacement as the fourth DHC component of IOTN was performed on the greatest displacement of point of contact. Clinically, displacement of contact point is also called crowded teeth. Displacement of contact point cannot describe teeth in general because only the largest point of contact is recorded. In this study, all subjects experienced a displacement of point of contact. In a study conducted by Singh et al., crowded teeth were also a common type of malocclusion.[12]

The fifth component was measurement of deep bite and open bite. Open bites are rare compared with deep bites. In this study, only 3 subjects (5.77%) experienced open bite, whereas 17 subjects (32.69%) had deep bite. The comparison is in line with the research by Singh et al. that reported as much as 2.03% of subjects experiencing open bite and 13.23% experiencing deep bite.[12]

On the basis of these components, the DHC grade was then determined. DHC grade is determined by the most severe or dominant abnormality in the teeth. In this study, most of the subjects (55.8%) had grade 4 DHC that required orthodontic treatment. The distribution of severity (as shown in Figure 1) is similar to that reported by Shue-Te Yeh et al.[15] also using DHC from IOTN, with a majority of grade 4 cases and no grade 1 cases. The study of Shue-Te Yeh et al

has many similarities with the present study, but it was conducted using a pre-treatment model from orthodontic clinics in San Francisco, California, USA.[15]

Conclusions

The majority of patients seeking treatment at the Orthodontic Clinic of RSKGM FKG UI Salemba from 2010 to 2014 objectively required orthodontic treatment (Grades 4), it shows objectively according to the patients' malocclusion severity, most of the patients need the orthodontic treatment; whereas the category of great need orthodontic treatment (Grade 5) was the least number of patients. The most common clinical state found in the subjects was dental crowding, whereas the least common one was loss of teeth, which could be found both anterior and posteriorly.

Declaration of Interest

The authors report no conflict of interest.

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