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The Effect of Anterior Crowding Toward Oral Hygiene Index-Simplified and Gingival Index Score

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ABSTRACT
Dental crowding is one form of malocclusion characterized by disparities between the size of the tooth and the arc dimension. It is commonly found in the anterior region. Keeping the crowded and misaligned tooth is hard, leading to more plaque accumulation and increasing the risk of gingival inflammation. This research aims to find the effects of anterior dental crowding on the Oral Hygiene Index-Simplified (OHI-S) and Gingival Index scores of Poltekkes Kemenkes Kupang students. This is a cross-sectional study performed by observational analytical study design. The population was the student of Poltekkes Kemenkes Kupang with anterior crowding. Using 70 samples were chosen using purposive sampling technique. The result showed that most of the students had moderate anterior crowding (45.7%), followed by mild crowding (30%) and severe crowding (20%). The chi-square test showed a significant effect of anterior crowding toward OHI-S (p=0.03) and GI scores (p=0.04). While Socio-economical aspect also showed a significant effect (p=0.00) on OHI-S scores. A significant effect of socioeconomic status was also recorded on GI score (p=0.00). An observation of the students' oral hygiene intention showed that they mostly had a moderate intention (72.9%) to keep their mouth clean, and the rest, 27.1% had high oral hygiene intention. This aspect also significantly affects their scores of OHI-S (p=0.00) and GI (p=0.01). This study concluded that anterior crowding, socioeconomic status, and oral hygiene intention can affect OHI-S and GI scores of the students of Poltekkes Kemenkes Kupang

Keywords: *Dental Crowding; Socio-Economic Status; Oral Hygiene Intention; OHI-S; Gingival Index*

ABSTRAK

Gigi berjejal dianggap sebagai salah satu jenis maloklusi, menyimpang dari oklusi normal meliputi ketidak teraturan gigi dan lengkung gigi, ukuran gigi besar sering ditemukan pada region anterior. Gigi berjejal kesulitan dibersihkan dengan menyikat gigi, Kondisi ini dapat

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terjadi penumpukan plak yang juga merupakan salah satu faktor resiko terjadinya gingivitis. Penelitian ini bertujuan untuk mengetahui pengaruh gigi anterior berjejal terhadap indeks OHI-S dan Indeks Gingivitis pada mahasiswa Poltekkes Kemenkes Kupang. Metode Penelitian adalah penelitian observasional analitik dengan rancangan penelitian menggunakan cross sectional. Populasi penelitian ini yaitu mahasiswa Program Studi Poltekkes Kemenkes Kupang yang memiliki gigi berjejal anterior. Sampel berjumlah 70 orang dan pengambilan sampel dilakukan dengan teknik purposive sampling. Hasil penelitian Gigi berjejal anterior termasuk kriteria sedang (45,7%), ringan (30%) dan berat (20%). Hasil analisa Uji chi Square ada pengaruh yang signifikan antara gigi berjejal anterior terhadap OHI-S (p=0,03) maupun pengaruh signifikan gigi berjejal anterior dengan gingivitis (p=004). Penghasilan orang tua mahasiswa Rp. 3.000.000-2.000.000(44,3%), 1.999.999-1.000.000 hanya (28,6%). Uji Chi Square di dapatkan nilai Sig. 0,00 < 0.05 artinya terdapat pengaruh antara Status Sosial Ekonomi Orang Tua dengan OHI-S. sedangkan gingivitis termasuk kriteria ringan ada 20 mahasiswa. Nilai siignifikansinya p =0,00 < 0.03 maka ada pengaruh Status Sosial Ekonomi Orang Tua dengan Indeks Gingivitis. Sedangkan motivasi mahasiswa terhadap perawatan gigi berjejal termasuk kriteria cukup (72,9%) dan motivasi baik hanya (27,1%). Hasil analisis menunjukkan ada pengaruh signifikan motivasi mahasiswa terhadap perawatan gigi berjejal dengan OHI-S (p=0,00) dan pengaruh signifikan motivasi mahasiswa dengan gingivitis (p=001). Kesimpulan: Hasil penelitian menunjukkan ada pengaruh gigi anterior berjejal terhadap indeks OHI-S dan Indeks gingivitis, status sosial ekonomi, motivasi perawatan gigi berjejal pada mahasiswa Program Studi Poltekes Kemenkes Kupang (p<0,05).
Kata kunci: Hypnobreastfeeding; Pijat Laktasi; Produksi ASI

INTRODUCTION

Dental crowding denotes one form of malocclusion (Gibreal, Hajeer and Brad, 2019), characterized as discrepancies between the size of the tooth and arc dimension (Erliera, Rika Mayasari Alamsyah and Novita Zein Harahap, 2015), that can also manifest with malaligned tooth and commonly found in anterior region (Manalip, Anindita and Tendean, 2020). The lingually inclined maxillary or mandibular anterior tooth can be caused by both skeletal or functional factors (Nainggolan, Ardhana and Christnawati, 2015).

According to (Proffit *et al.*, 2019), there are factors leading to crowded tooth, one of which is primary teeth persistence, improper tooth bud position. Malocclusion might interfere masticatory, swallowing, and speech function. In some cases, it might also cause psychological issues related to esthetic aspect, self-esteem and image (Ashky *et al.*, 2019). In Indonesia, malocclusion ranks the third highest dental problems following caries and periodontal diseases. Although not belong to infectious diseases, malposition tooth also bothers dental and oral health in the same manner

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(Erliera, Rika Mayasari Alamsyah and Novita Zein Harahap, 2015).

There are factors causing malocclusion, such as genetic, congenital trauma, environmental factors, improper amount, size, and the shape of the teeth, disrupted tooth bud formation and eruption. Besides, hyperfunctioning endocrine gland and calcium metabolism might also contribute to malocclusion due to disrupted development of the jaw. Meanwhile prolonged retained of primary teeth is mostly caused by genetic and trauma factors (Iswari, 2013).

The crowded tooth are usually hard to be brushed (Sasea, Lampus and Supit, 2013). This can degrade oral hygiene, increasing the risk of gingivitis (Imai, Yu and MacDonald, 2012; Riyanto, 2021). A study on PAB 5 high school student stated that more plaque accumulation recorded on those with dental crowding due to difficult to keep it clean (Asmawati, Hamsar and Hamidah, 2019). Therefore, clean the teeth properly is an important measure required prior to orthodontic treatment to prevent gingivitis (Sasea, Lampus and Supit, 2013; Bahirrah, 2018).

Gingivitis is gingival inflammation caused by bacteria invasion from the accumulated dental plaque (Widodorini *et al.*, 2018). In addition to malocclusion, socioeconomic status also affects oral hygiene and gingival health (Ravaghi *et al.*, 2019). Lower income tend to diminish access to health facilities (Ravaghi *et al.*, 2019). The better the socioeconomic status, the easier access to get knowledge about oral health and good oral health facilities, and better lifestyle (Hutami, Himawati and Widyasari, 2019).

Another factors that might also contribute to oral hygiene and health is intention, an individual willingness to do measures for a certain goal (Zuhriza *et al.*, 2021). According to Kumar *et al.*, (2019), oral hygiene intention contributes in preventing dental and oral diseases. The higher the intention, the better their Oral-Health-Related Quality of Life (Zuhriza *et al.*, 2021).

A study by Obi & Variani, (2021) stated 67.5% patients with anterior dental crowding had good oral hygiene, while the rest 42.5% had bad oral hygiene and suffered from caries. This study is conducted with students of Poltekkes Kemenkes Kupang chosen from 7 major studies with anterior crowding. A previous pilot study in 2021 revealed that most of the students had anterior crowding ranging from mild to severe. This study aiming to

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evaluate any factors that might influence OHI-S and GI scores of the students, including anterior crowding, socioeconomic status and oral hygiene intention.

METHOD

The methods implemented in this study had been reviewed and approved by the institutional review board, with ethical clearance certificate No.LB.02.03/1/0098/2022. This is a cross-sectional study with analytic observational study design. The study was conducted on February 2022 in Poltekkes Kemenkes Kupang. A number of 70 samples were choosen among the students by means of purposive sampling. The inclusion criteria are active student at Poltekkes Kemenkes Kupang, had dental crowding, agree to participate by signing a consent form, while students undergoing orthodontic treatment, wearing denture, refuse to participate, and absent during the data aquiring process were excluded from the study.

The degree of dental crowding was assessed according to (Proffit *et al.*, 2019), with the following criteria: no crowding (0-1mm dental arc length discrepancy), mild crowding (2-3mm discrepancy), moderate crowding (10mm discrepancy), and extreme crowding (more than 10mm discrepancy) (Riyanto, 2021).

The oral hygiene was measured using OHI-S index adapted from Greene Vermillion method. The examined teeth were all the maxillary and mandibular first permanent molar, upper first right incisor, and lower left incisor. If there is any first molar loss, we assess the second or third molar instead. If the first right incisor was loss, we assess the left instead. A layer of disclosing agent was applied to the destined teeth, and leave for 30 seconds. The respondents were subsequently asked to rinse their mouth, then the operator will assess the OHI-S score.

The scores were tabulated in a record sheet (Salim *et al.*, 2021). The gingival health was assessed by means of Modified Gingival Index. An assessment of 4 different areas (2 marginal and 2 papilla) was performed, and scored from 0 to 4. Similar to OHI-S, we assessed the gingival of all 4 first molar, upper right incisor, and lower left incisor. If the destined teeth were missing, we would assess the teeth on its mesial side instead.

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The research instruments used in this study are questionnaire, dental crowding assessment form, OHI-S, and GI. The tooth assessment was performed using diagnostic kit, periodontal probe, and mask + gloves for universal precautions. While the ingredients used were alcohol, cotton, soap, water, and disclosing agent.

The acquired data was processed and tabulated, then analyzed using descriptive analysis; normality test using Shapiro Wilk. The correlation test between dental crowding; socioeconomic status; oral hygiene intention; toward OHI-S and GI score was performed using Chi-square test. The statistical analysis was performed using SPSS at significance level of $p<0,05$

RESULTS AND DISCUSSION

Table 1. The study participants characteristics

Variable	Frequency	Percentage
Age		
17 y.o.	1	1,4
18 y.o.	24	34.3
19 y.o.	24	34.3
20 y.o.	14	20.0
21 y.o.	5	7.1
22 y.o.	1	1.4
23 y.o.	1	1.4
Gender		
Male	8	11.4
Female	62	88.6
Total	70	100

A univariate data analysis was performed to identify the frequency distribution of the respondent's characteristics; namely dental crowding state, socioeconomic status, and oral hygiene intention. The characteristics of the respondents are presented in Table 1. Mostly the respondents are 18-19 years old (34.3%), followed by 20 years old (20.0%).

Table 2. Dental crowding, socioeconomic status, oral hygiene intention, OHI-S and GI scores

Variable	Frequency	Percentage (%)
Dental crowding		
Normal (0-1 mm)	0	0.0
Mild (2-3 mm)	21	30.0
Moderate (4-6 mm)	32	45.7
Severe (7 – 10 mm)	14	20.0

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Extreme (> 10 mm)	3	4.3
Parent socioeconomic status		
IDR ≥3.000.000	7	10.0
IDR 3.000.000-2.000.000	31	44.3
IDR1.999.999-1.000.000	20	28.6
IDR 1.000.000	12	17.1
Oral Hygiene Intention (24-30)	19	27.1
Good (17-23)	51	72.9
Low (10-16)	0	0,0
OHI-S scores		
Good (0- 1,2)	18	25.7
Moderate (1,3 – 3,0)	39	55.7
Low (3,0 – 6,0)	13	18.6
Gingivitis Index Scores		
Mild (1,2 – 1,6)	33	47.1
Moderate (2,7 – 4,4)	26	37.1
Severe (4,5 – 6,0)	11	15.7

The result of dental crowding assessment, socio-economic status, oral hygiene, and gingival health are presented in Table 2. Female respondents dominated by reaching a portion of 88.6%. As for dental crowding, mostly respondents had moderate (45.7%) anterior crowding, followed by mild (30%), and severe (20%). Observed from the parent's income, the respondents were dominated by middle-socio-economic status with income range IDR 2,000,000 – 3,000,000 (44.3%), followed by low socio-economic status with income ranging from IDR 1,000,000 to 1,999,999. Mostly the respondents had enough intention to keep their oral hygiene (72.9%), while them who had good intention were just 27.1% of the population. Most of the respondent had moderate oral hygiene (55.7%), while those with good oral hygiene were only 25.7% of the population. As for gingival health, fortunately, mostly had mild gingivitis (47.1%), followed by moderate (37.1%), and severe (15.7%).

Table 3. The effect of anterior crowding to OHI-S and GI scores

Anterior	**OHI-S**			**Total**	**Sig**	**Gingivitis**			**Total**	**Sig**
crowding	**Good**	**Moderate**	**Low**			**Mild**	**Moderate**	**Severe**		
Mild	7	21	3	21		12	6	3	21	
Moderate	7	32	7	32		11	14	7	32	
Severe	10	14	0	14	0,03	5	9	0	14	0,04
Extreme	2	3	1	3		1	0	2	3	
total	7	70	3	70		29	29	12	70	

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As can be seen on table 3, mostly the respondents had moderate crowding (45.7%), followed by mild (30.0%). The correlation assessment, showed a significance level of 0.03 for correlation between anterior crowding and OHI-S. while for GI scores showed a significance of 0.04. competence (27.8%)

Table 4. The effect of socio-economic status to OHI-S and GI scores

Parents socio-economic status	**OHI-S**			**Total**	**Sig**	**GI**			**Total**	**Sig** p
	Good	**Moderate**	**Low**			**Mild**	**Moderate**	**severe**		
< IDR 1.000.000	3	1	6	10		0	5	5	10	
IDR 1.999.999-1.000.000	9	11	2	22	0,00	10	9	3	22	0,00
IDR 3.000.000-2.000.000	5	20	2	27		15	10	2	27	
> IDR 3.000.000	9	1	1	11		4	5	2	11	
Total	26	33	11	70		29	29	12	70	

There were 31 respondents with parent`s income ranging from 2-3 million rupiah in a month, and only 20 respondents with income ranging from 1-2 million rupiah. The Chi Square test showed a significance level of 0.00 for the correlation between parent`s socio-economic status toward OHI-S score. The same result was also recorded for correlation between parent`s socio-economic status toward GI score, with significance level of 0.00.

Table 5. The effect of oral hygiene intention to OHI-S and GI scores

Oral hygiene intention	**OHI-S**			**Total**	**Sig**	**GI score**			**Total**	**Sig**
	Good	**Moderate**	**Low**			**Mild**	**Moderate**	**Severe**		
Good	20	16	3	39		20	15	4	39	
Fair	6	16	7	29		9	14	6	29	0,01
Low	0	1	1	2	0,00	0	0	2	2	
total	26	33	11	70		29	29	12	70	

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The correlation between oral hygiene intention and OHI-S and GI scores is presented in Table 5. It showed a significant correlation between the respondent's oral hygiene intention and OHI-S (p=0.00) and GI scores (p=0.001). The acquired data of this study showed that the number of respondents with moderate anterior crowding was 45.7%, and mild anterior crowding was 30.0%. The result showed that anterior crowding is still common in Kupang. Another study by (Sasea, Lampus and Supit, 2013) also stated that most of the findings showed crowding in both arcs (Sasea, Lampus and Supit, 2013). The anterior crowding can be caused by hereditary and environmental factors. The hereditary factors may contribute to the inconsistence of tooth size and number, and the available space on dental arc (Erliera, Rika Mayasari Alamsyah and Novita Zein Harahap, 2015). Another study showed different result, stating that bad oral habit contributed to 52.7% of anterior crowding cases (Pruthi, Sogi and Fotedar, 2013).

While another study revealed that supernumerary teeth also contribute to the teeth position and alignment (Iswari, 2013). Another study by Roesianto, Suwindere, & Sembiring (2018) stated that teeth infraction, fracture, masticatory disorder, caries, gingivitis, periodontitis and gingival recession might also had effect on dental crowding. The degree of dental crowding is affected by the available space in dental arc, the number of teeth, proximal attrition, and the willing to treat dental crowding (Hafez *et al.*, 2012; Zou *et al.*, 2018). The effect of environmental factors toward dental crowding is not clear yet, however, another study had found the evidence of nutritional intake effect toward dental crowding (Normando, Almeida and Quintão, 2013).

This study showed that OHI-S scores of the respondents were 55.6% moderate, 25.7% good, and 18.6% bad. There is correlation between anterior crowding toward OHI-S scores in the students of Poltekkes Kemenkes Kupang. Another study also showed similar result of OHI-S scores in college students of Sam Ratulangi, which most of the students had moderate oral hygiene status (Sasea, Lampus and Supit, 2013).

Table 2 is showing that those with anterior crowding had mild gingivitis (47.1%), moderate gingivitis (37.1%), and severe gingivitis (15.7%). The chi square analysis showed a significance of 0.04; which means there is a correlation between anterior crowding and gingivitis. Previous study also showed a correlation between dental

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crowding and gingivitis in children (Riyanto, 2021). Dental crowding denotes irregular tooth alignment (Imai, Yu and MacDonald, 2012), that might complicate the oral hygiene practice (Riyanto, 2021). Dental crowding usually presents together with gingival infection. Gingivitis is characterized by reddish, swollen, and easy to bleed gingiva. This condition is caused by bacterial infection from the accumulated plaque in the area near the gingival margin. Dental crowding may cause the food impacted in the proximal area, increasing risk of gingivitis (Yosa and Wahyuni, 2015). Gingivitis can be prevented by regular tooth-brushing twice a day (Santi and Khamimah, 2019). A good oral hygiene practice is more important than orthodontic treatment, in case of dental crowding (Bahirrah, 2018).

An observation on socio-economic status showed that most of the respondents are economically stable with income ranging from IDR 2-3 million (44.3%), followed by moderate economic status with income ranging from 1-2 million (28.6%). The information was acquired through the self-reported questionnaire. The statistical analysis showed a significant correlation between parents' socio-economic status to the OHI-S scores (p-0.00). A previous study stated that a good income is usually supported by good formal-education level, which might contribute to the oral hygiene practice, thus, better oral health (Molina-Frechero *et al.*, 2017).

A study on elementary and high school in Mexico also showed a significant correlation between parents income and dental crowding stage (p = 0.050) (Pérez, Pineda and Olivares, 2021). There is limited study available regarding the negative correlation between socio-economic status with malocclusion. The social-economic condition of a family may contribute to the health, in general, and oral-health related quality of life. A low income may rise disparities in social life, including the access to the health services (Ravaghi *et al.*, 2018). On the contrary, another study showed no correlation on socio-economic status of the parents with the children malocclusion classification (Öz and Küçükeşmen, 2019).

The chi square analysis showed a correlation between parents' economic status to the gingivitis. A study stated that in a country with lower income, parents with lower educational level, are tend to had lower dental health services and lower oral and dental hygiene (Fan *et al.*, 2021). Another study showed a strong correlation between socio-economic status with high incidence of

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periodontitis in children, high prevalence of gingival bleeding, calculus, and bad oral hygiene. The untreated gingivitis may lead to further damage to the periodontal tissues (Chen *et al.*, 2020).

An intention is a strong urge that can produce an individual response to take action, to reach the goal, and motivate self to do a certain action. This study found that the respondents had enough intention (72.9%), and the rest 27.1% had low intention to keep oral hygiene. There is also a correlation between oral hygiene intention to the OHI-S scores (p=0,00). This showed that the students of Poltekkes Kemenkes Kupang had enough intention to perform a proper oral hygiene practice.A previous study stated that a good intention can motivate an individual to keep performing a proper oral hygiene practice (Lendrawati, 2013). A dental healthprogram should be prepared carefully to prevent a dental disease. A study on Medical students of Diponegoro University found that the better oral hygiene intention, the better their quality of life (Zuhriza *et al.*, 2021). The current research showed a significant correlation between oral hygiene intention of those with anterior crowding and gingivitis (p=001). Through the continuous motivation and instruction to keep oral hygiene and regular dental visit in every 6 months, can improve an individual oral hygiene, health, and their quality of life (Bahirrah, 2018). Another study stated that additional extrinsic motivation can improve the respondents intention to keep oral hygiene, compared to intrinsic motivation only (Kumar *et al.*, 2019). In order to get intention and motivation to perform a proper oral hygiene practice is not an easy task, due to long-life habit and lifestyle. A proper effective approach is required to motivate someone to perform a proper oral hygiene practice at home.

A study in Suburb Nigeria showed a correlation between malocclusion with mild gingivitis, moderate gingivitis (26.9%), and severe gingivitis (0.2%); while anterior open bite also correlates to mild gingivitis (8.2%). The study showed no significant correlation between no crowding, overjet, increase overbite, cross bite and gingival health status (Kolawole and Folayan, 2019). Dental crowding is correlated to oral hygiene, and thus, gingivitis. Gingivitis is an inflammation in the gingiva, characterized with redden, swollen, and easy to bleed gingiva during brushing the teeth. This condition is caused by bacterial infection due to the accumulated plaque (Yosa and Wahyuni, 2015). The treatment for gingivitis can be performed by removing accumulated

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calculus regularly, keep performing a proper practice of oral hygiene including brushing tooth, using mouthwash and dental floss. Those treatment can also be supported by balance diet and nutritional intake, and receiving orthodontic treatment for those with dental crowding.

CONCLUSION

According to the result of this study, it can be concluded that 70 students of Poltekkes Kemenkes Kupang in 2022 had dental crowding, with moderate level (45.7%), moderate oral health (55.7%), and suffered from gingivitis 47.1%. Their parent's income are belong to mid-level (55.7%) with income ranging from IDR 2-3 million. Mostly of the respondents had enough intention to perform a proper oral hygiene practice (72.9%). It is concluded that there is correlation between anterior crowding with OHI-S score and GI scores, economic status, and oral hygiene intention of the students of Poltekkes Kemenkes Kupang.

It is recommended for the head of the study program to also intensively care for the student's oral health, and encourage them to visit dentist regularly to get the appropriate treatment. This is expected to be a good measure to increase their oral health status, and the student's quality of life.

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