The severity level of malocclusion and orthodonthic treatment needs based on the index of orthodonthic treatment need (IOTN) on students aged 9-12 years old at candijati jember 1 state elementary school

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Abstract

Malocclusion is a condition of dental occlusion that is not suitable from normal conditions that affect oral function and facial aesthetics and has now become a great concern in the health sector. Malocclusion occurs mostly in children aged 9-12 years which is the second phase of the mixed teeth period. The severity's level of malocclusion and orthodontic treatment needs can be measured using the malocclusion index, one of which is the Index of Orthodontic Treatment Need (IOTN). Dental Health Component (DHC) is one component of IOTN that is effective in overcoming malocclusion and has good potential for orthodontic treatment because it assesses objectively by examining and measuring the circumstances of the teeth. The purpose of this study was to determine the severity of malocclusion and orthodontic treatment needs based on the Index of Orthodontic Treatment Need (IOTN) in students aged 9-12 years at SDN 01 Candijati Jember. Sampling was determined using the total sampling method on subjects encountered inclusion criteria; 96 samples were obtained. This study was conducted by measuring the study model of the patient's dental printing results based on DHC from IOTN and analyzed descriptively. The results of the study found the severity of malocclusion and the need for orthodontic treatment based on the Index of Orthodontic Treatment Need (IOTN) in students aged 9-12 years SDN 01 Candijati Jember is most commonly found in grade 2, namely mild malocclusion with little need for treatment. Then the severity's level of malocclusion and the need for orthodontic treatment is greater in women than men and great-est in students aged 12 years.

Keywords: *Malocclusion; The Severity's Level of Malocclusion; Orthodontic Treatment Needs; Index of Orthodontic Treatment Need (IOTN); Dental Health Component (DHC).*

1. Introduction

Malocclusion is a condition of dental occlusion that is not suitable from normal conditions Malocclusion problems that affect oral function and facial aesthetics have become a great concern of dental health. Malocclusion can happen because factor general and local. General factors of malocclusion are hereditary factors, congenital damage, environment factors, deficiency nutrition, and bad habits whereas local factors of malocclusion are anomalies quantity, shape and size of teeth, anomalies form lips, premature loss, and caries [1]. If malocclusion doesn't get treatment it can cause bad face apperance, temporomandibular joint disorders, speech disorders, risk of caries, periodontal disease and trauma [2].

Malocclusion occurs mostly in children aged 9-12 years which is the second phase of the mixed teeth period. At the age of 9-12 years, it is included in the orthodontic interceptive period, which is a period in children who are in the phase of mixed teeth and have the potential to experience malocclusion[2]. Based on the results of a study by Anindita et al. (2023) on 140 children aged 9-12 years in the coastal area of Manado City, the prevalence of malocclusion was 99.28%[3].

Malocclusion epidemiology requires a quantitative and objective assessment that limits deviations from normal occlusion and then separate malocclusion according to level of severity and orthodontic treatment needs. The severity's level of malocclusion is useful to see the scale of orthodontic treatment required whereas needs of orthodontic treatment is aimed to fixing malocclusion that can affect the health of the teeth and oral cavity as well as looks of someone's face [4]. The severity's level of malocclusion and orthodontic treatment needs can be measured using the malocclusion index, one of which is the Index of Orthodontic Treatment Need (IOTN) [5].

Index of Orthodontic Treatment Need (IOTN) is one of the indices that describes the severity of malocclusion and the need for orthodontic treatment in a population. Assessment of malocclusion severity and orthodontic treatment needs based on IOTN has been agreed upon internationally because this method has been proven to be valid and trustworthy [6]. IOTN has the advantage of being easy to use and

simple compared to other indices. IOTN consists of two components, namely the Aesthetic Component (AC) and the Dental Health Component (DHC) [7].

Aesthetic Component (AC) assesses a person's perception of the appearance of the patient's teeth through a photographic scale, where there are 10 points that show the level of appearance of the most aesthetically attractive teeth and 10 photos represent the least aesthetically attractive teeth[8]. AC measurements were obtained by taking photos of the state of the anterior teeth of the research subjects using a camera, while DHC measurements were carried out by examining the study model of the research subjects. The Dental Health Component (DHC) assesses abnormalities that are seen sequentially and is an acronym for MOCDO, which is in the form of the letter prefix of Missing, Overjet, Crossbite, Displacement of contact point, Overbite including openbite. DHC divides the severity of malocclusion and the need for treatment into 5 grades, namely grade 1 normal occlusion, no treatment, grade 2 mild malocclusion, requiring mild treatment, grade 3 moderate malocclusion, requiring borderline treatment, grade 4 severe malocclusion, requiring treatment and grade 5 very severe malocclusion, requiring treatment. According to Kharpanda (2020), DHC is more effective in overcoming malocclusion and has good potential for orthodontic treatment because it assesses objectively by examining and measuring the state of the teeth[7]. This shows that an attractive or ideal anterior appearance of teeth does not necessarily have other anomalies [6].

Alatrach's (2014) study conducted in Syria on 200 children aged 8-13 years old found that the severity of malocclusion using the Dental Health Component IOTN was (60.2%) mild malocclusion, (30%) moderate malocclusion and (9.8%) severe malocclusion [9]. Based on research by Nofrizal et al. (2023) on 22 children aged 9-11 years old at RSGM Trisakti University, it was found that the level of Dental Health Component treatment needs based on gender, namely women with little need for treatment 4 samples (13.8%), need moderate treatment 11 samples (38%), need treatment 6 samples (20.7%) and very need treatment 1 sample (3.4%). Males requiring moderate treatment 4 samples (13.8%), and requiring treatment 3 samples (10.3%)[10].

This research was conducted at SDN 01 Candijati Jember. Candijati Village is one of the agro-industry villages located in the Arjasa District area and precisely in Jember Regency [11]. Previous research has explained that the residents of agro-industry areas in Jember Regency have low dental and oral health due to the lack of knowledge and information about dental and oral health obtained [12]. In the research of Kiswaluyo et al. (2023), it was found that there was dental caries in 36 grade 5 students at SDN 01 Candijati and SDN 04 Biting Arjasa amounting to (88.9%) [13]. The existence of a fairly high caries rate can cause malocclusion if not treated. In accordance with the background description that has been described above, the author wishes to conduct research on the severity of malocclusion and the need for orthodontic treatment based on the Index of Orthodontic Treatment Need (IOTN) in students aged 9-12 years at SDN 01 Candijati Jember.

2. Method

This type of research is quantitative, using a descriptive observational method with a cross-sectional approach. The research was carried out at SDN 01 Candijati, Arjasa District, Jember Regency in January-February 2024. The population in the study is a print of a study model on students aged 9-12 years old. The samples obtained were 96 samples with a total sampling technique. The variables in this study were the severity of malocclusion, the need for orthodontic treatment, the Index of Orthodontic Treatment Need (IOTN), the Dental Health Component (DHC), and children aged 9-12 years. Data collection in this study was carried out by adhering to the results of the study model print on students aged 9-12 years at SDN 01 Candijati using the Dental Health Component (DHC) from the Index of Orthodontic Treatment Need (IOTN). The data obtained were then analyzed descriptively based on age, gender, severity of malocclusion, and the need for orthodontic treatment. This research was carried out based on the assessment decision letter and research recommendations issued by the Health Research Ethics Committee, Faculty of Dentistry, University of Jember on January 8, 2024.

3. Results

Based on research that has been carried out is obtained results.

Table 1: General Characteristics of the Study Sample

Age	Gender Woman	Man	Number of Samples	Percentage
9	9	15	24	25
10	14	10	24	25
11	13	12	25	26.04
12	9	14	23	23.96
Total	45	51	96	100

Based on Table 1. general characteristics of the research sample were mostly female as many as 45 samples, while the number of male samples was 51 samples. The sample of this study was mostly at the age of 11 years old as many as 25 samples and the lowest at the age of 12 years old was 23 samples.

Table 2: Malocclusion Status and Level of Treatment Need Based on DHC

Grades	Malocclusion Status	Level of Treatment Needs	Number of Samples	Percentage
1	Normal	No requiring treatment	7	7.29
2	Mild	Requiring mild treatment	45	46.88
3	Moderate	Requiring borderline treatment	20	20.83
4	Severe	requiring treatment	20	20.83
5	Very severe	requiring treatment	4	4.17
Total			96	100

Based on Table 2. status of malocclusion and the need for treatment are dominated in grade 2 with a mild degree of malocclusion with little treatment, namely as many as 45 children or (46.88%) and the least in grade 5, namely severe malocclusion and very needing orthodontic treatment as many as 4 children or (4.17%).

Table 3: Distribution of the DHC-IOTN Index by Gender

Grades	Severity and need for treatment	Female (n) (%)	Male (n) (%)
1	Normal occlusion, no requiring treatment	4 (9.09)	3 (5.77)
2	Mild malocclusion, requiring mild treatment	16 (36.36)	29 (55.77)
3	Moderate malocclusion, requiring borderline treatment	9 (20.45)	11 (21.15)
4	Severe malocclusion, requiring treatment	11 (25)	9 (17.3)
5	Very severe malocclusion, requiring treatment	4 (9.09)	0 (0)
Total		45 (46.88)	51 (53.12)

Based on Table 3. distribution of the DHC-IOTN index by gender was obtained with the largest number of samples in grade 2 girls, namely 16 children or (36.36%) and at least 4 children or (9.09%) in grade 1. In the male sex sample, the largest sample was in grade 2, namely 29 children or (55.77%) and the least in grade 5 as much as 0.

Table 4: Distribution Index DHC-IOTN Based on Age

Grades	Severity and need for treatment	Age			
		9 (n) (%)	10 (n) (%)	11 (n) (%)	12 (n) (%)
1	Normal occlusion, no requiring treatment	2 (8.33)	2 (8.33)	3 (12)	0 (0)
2	Mild malocclusion, requiring mild treatment	10 (41.67)	10 (41.67)	13 (52)	12 (52.17)
3	Moderate malocclusion, requiring borderline treatment	8 (33.33)	4 (16.67)	5 (20)	3 (13.04)
4	Severe malocclusion, requiring treatment	3 (12.5)	6 (25)	4 (16)	7 (30.43)
5	Very severe malocclusion, requiring treatment	1 (4.17)	2 (8.33)	0 (0)	1 (4.35)
Total		24 (25)	24 (25)	25 (26.04)	23 (23.96)

Based on Table 4. DHC-IOTN index distribution in 9-year-old children out of 24 children was obtained with a maximum sample of 10 children or (41.67%) classified as grade 2 or mild malocclusion and requiring little treatment. In 10-year-olds out of 24 children, the maximum number of samples was obtained 10 children or (41.67%) classified as grade 2 or mild malocclusion and requiring little treatment, in 11-year-old children out of 25 children the maximum number of samples was obtained 13 children or (52%) classified as grade 2 or mild malocclusion and requiring little treatment. In 12-year-old children out of 23 children, the maximum number of samples was 12 children or (52.17%) classified as grade 2 or mild malocclusion and required little treatment.

Table 5: Categories Deviation Tooth Based on MOCDO DHC-IOTN

Category Deviation	Frequency	Percentage
Missing teeth	17	17.71
Overjet	56	58.33
Crossbite	13	13.54
Displacement of contact points	57	59.38
Overbite	65	67.71

Based on Table 5. largest tooth deviation based on MOCDO DHC-IOTN was obtained in overbite, which was 57 children or (59.38%) and the least in missing teeth deviation, which was 17 children or (17.71%).

4. Discussion

Malocclusion is an unbalanced relationship between the teeth, jawbone and skull, as well as the surrounding muscles that cause poor aesthetics and functional imbalance [14]. Malocclusion can be corrected with orthodontic treatment. Orthodontic treatment has been recommended to improve oral and speech function[6]. The determination of the severity and need for orthodontic treatment can be identified by the Index of Orthodontic Treatment Need (IOTN). IOTN has 2 components, namely the Aesthetic Component (AC) and the Dental Health Component (DHC). AC assesses the severity of malocclusion and the level of need for orthodontic treatment based on a photographic scale, while DHC assesses several types of malocclusion such as overjet, overbite, openbite, crossbite, crowding, obstructed palatal eruptions, cleft lip or palatals, and hypodontia[8]. In this study, the researcher used DHC components, because DHC is more thorough in conducting assessments.

The sample of this study uses the age criteria of 9-12 years. At the age of 9-12 years, it is the second phase of the mixed teeth period. During this period, there is a change from the first tooth to the permanent tooth which causes many problems. Occlusion sometimes becomes inappropriate so that there can be a state of crammed teeth, cross bites, open bites, and deep bites. If left untreated, malocclusion can get worse and require orthodontic treatment. The results of the research are in Table 2. The status of malocclusion and the level of treatment need based on DHC in children aged 9-12 years were found that the largest number of samples were children classified as grade 2, namely mild malocclusion and requiring little orthodontic treatment as much as (46.88%). This is in line with the research of Lubis and Laturiuw (2018) on the need for orthodontic treatment at SMP 15 Medan using DHC, 100 children who are classified as grades 1-2 with a percentage (89%), grade 3 with a percentage (8%) and grades 4-5 with a percentage (3%) [15]. Likewise, a study conducted by Kolonio et al. in 2016 showed that the severity of malocclusion and the need for orthodontic treatment were more in grade 2 or mild malocclusion and required less treatment, which was as much as (30%), especially in 30 children aged 12-13 years at SMP Negeri 1 Wori[6]. Malocclusion in this study may be caused by low socioeconomic levels and bad habits owned by children. Bad habits that continue after the age of six can result in malocclusion, abnormalities in the shape of the face, and abnormalities in the shape of the palate[16]. Bad habits also affect dentofacial functions such as the process of chewing, speaking, dental occlusion, tooth support tissue structure and aesthetics (Gupitasari, 2018). Bad habits that are often practiced by children include sucking on the thumb, pushing the tongue, biting the lips and nails, wrong swallowing habits, breathing through the mouth, and bruxism [17], [18].

Research that has been conducted by Rezalinoor et al in 2017 stated that the severity of malocclusion and the need for orthodontic treatment in women is higher than that of men[8]. The results of the study on the severity of malocclusion and the need for orthodontic treatment based on gender based on DHC components in males with a total of 28 students were obtained grade 1-2 with indications of not needing/mild treatment as much as (32.1%), grade 3 with indications of moderate/borderline treatment as much as (10.7%) and grades 4-5 with indications of very needing treatment as much as (57.1%). In women with a total of 32 students, grades 1-2 were obtained with indications of not needing/mild treatment as much as (18.7%), grade 3 with indications of moderate/borderline treatment as much as (12.5%) and grades 4-5 with indications of very needing treatment as much as (68.7%). In Table 3. It was found that the severity of malocclusion and the need

for orthodontic treatment in women were higher than in men. This can be seen in the female gender, the percentage in grades 4 and 5 is higher than that of men. The difference in the severity of malocclusion and the need for orthodontic treatment in men and women can be caused by variations in growth acceleration that can affect the size of the jaw arch. Generally, it occurs in women at the age of 10-12 years and in men, namely at the age of 12-14 years [19]. Malocclusion can be related to genetic factors that cause differences in the size of the width of the teeth with the size of the jaw arch, for example, large teeth with small jaws, the size of large teeth and small jaws is a condition inherited from both parents. The disharmony between the size of the tooth width and the width of the tooth arch is also related to the growth of the jaw being inhibited. Jaw growth is affected by the child's diet and chewing. The habit of consuming and chewing soft foods can affect the growth of jaw size where chewing provides a stimulus to jaw growth [20]. According to Anzarkusuma et al. (2014), girls tend to like snacks more than boys. The lack of stimulus in jaw growth can trigger malocclusion, especially in girls who consume snacks more often [21].

Age differences in children aged 9-12 years do not affect the severity of malocclusion and the need for orthodontic treatment. At that age, children have a varied pattern of growth and development of teeth and jaws. This is influenced by socioeconomic factors such as parents income which can affect the nutritional status of children. If poor nutritional status lasts for a long time, chronic malnutrition will occur which can interfere with the growth and development process. Nutritional intake that is not in accordance with what is needed by the body can affect the formation and development of the jaw and facial bones during the child's growth and development. In addition, the growth and development of skull and jaw bones can be slower than children who have good nutritional intake [22]. Late eruption of permanent teeth is one of the manifestations of malnutrition. Lack of weight can affect the delay in the occurrence of permanent tooth eruptions. Delayed eruption of permanent teeth can affect the teeth that are nearby, because the teeth will move to fill the empty space so that it can cause the permanent teeth to erupt in the wrong place and cause the teeth to be crammed [19], [23]. In Table 4. The highest severity of malocclusion and the need for orthodontic treatment is obtained at the age of 12 years This can happen because at the age of 12 the average child's teeth have completely erupted. Permanent teeth that have erupted completely can indicate the presence of more pronounced malocclusion. In line with research conducted by Adha in 2019, the highest severity of malocclusion in 12-year-old children was 25%, especially in 52 children aged 8-12 years at SDN Gambut 10. Meanwhile, according to research by Wijayanti et al. (2014) conducted in Cempaka Putih on 98 children aged 9-11 years using IOTN, the need for orthodontic treatment is the highest in 10-year-old children at 83.8% [24]. Malocclusion deviations in school-age children can occur due to the age factor of the child who does not have awareness that he or she needs orthodontic treatment, or does not have knowledge about orthodontic treatment. The role of parents in maintaining children's dental health in the age of growth and development is very necessary because the motivation of school-age children to take treatment of their teeth is still lacking so that children who experience malocclusion feel that they do not need [25], [26]. The Dental Health Component assesses malocclusion abnormalities that are seen sequentially and is an acronym for MOCDO, which is in the form of the letter prefix of Missing, Overjet, Crossbite, Displacement of contact point, Overbite including openbite. In Table 4.5 and Figure 4.4, the highest number of samples in overbite including openbite was obtained as many as (67.71%). In line with the research of Nahusona and Sari (2018), abnormalities from 226 children aged 11-12 years in Lalabata District were found to be 25.2% overjet, 25.2% overbite, 20.8% crossbite and 21.2% openbite [27]. Overbite disorder in children can be caused by several factors, for example abnormal growth patterns such as small jaw arch and persistence of the first teeth, excessive bite spacing so that the upper anterior teeth do not come into contact with the lower anterior teeth, narrow upper jaw arch, anterior teeth inclination forward, supraocclusive posterior teeth, and also by bad habits (tongue thrusting, sucking fingers, breathing through the mouth) [28].

The results of the study showed that the average severity of malocclusion and the need for orthodontic treatment were included in the mild category. This can happen because students aged 9-12 years at SDN 01 Candijati maintain good dental and oral health.

5. Conclusion

The severity of malocclusion and the need for orthodontic treatment based on the Index of Orthodontic Treatment Need (IOTN) in students aged 9-12 years at SDN 01 Candijati Jember are as follows.

1) The severity of malocclusion and the need for orthodontic treatment most often occurs in grade 2, which is mild malocclusion with little orthodontic treatment required
2) The severity of malocclusion and the need for orthodontic treatment in women is greater than in men.
3) The severity of malocclusion and the need for orthodontic treatment are most severe at the age of 12 years.
4) MOCDO-based malocclusion disorders in DHC are most common in overbite disorders.

References

[1] Premkumar, S. (2015). Textbook Of Ortodontics. India: Elsevier.
[2] Herawati, H., Sukma, N., Utami, R. D. (2015). Relationships Between Deciduous Teeth Premature Loss and Malocclusion Incidence in Elementary School in Cimahi. Journal of Medicine and Health. 1(2). https://doi.org/10.28932/jmh.v1i2.510.
[3] Anindita, P. S., Zuliari, K., Nanlessy. M. S. (2023). Prevalensi Maloklusi Pada Anak Usia 9-12 Tahun Di Daerah Pesisir Kota Manado. Jurnal e-GiGi (eG), 12(2); 168-174. https://doi.org/10.35790/eg.v12i2.50386.
[4] Axel, O. B., Anindita, P. S., Leman, M. A. (2015). Kebutuhan Perawatan Ortodonti Berdasarkan Index of Orthodontic Treatment Need Pada Usia Remaja 15 – 17 Tahun. Jurnal e-GiGi (eG), 3(2); 292-295. https://doi.org/10.35790/eg.3.2.2015.8770.
[5] Suala, H. N., Wibowo. D., Setyawardhana, R. H. D. (2021). Kebutuhan Perawatan Ortodonti Berdasarkan Index of Orthodontic Treatment Need Pada Remaja. Dentin Jurnal Kedokteran Gigi, 5(3). https://doi.org/10.20527/dentin.v5i3.4348.
[6] Kolonio, F. E., Anindita, P. S., Christy, N. Mintjelungan. (2016). Kebutuhan Perawatan Ortodonsi Berdasarkan Index Of Orthodontic Treatment Need Pada Siswa Usia 12-13 Tahun Di SMP Negeri 1 Wori. Jurnal e-GiGi (eG), 4(2). https://doi.org/10.35790/eg.4.2.2016.14164.
[7] Kharpanda, O. P. (2020). Orthodontics Diagnosis and Management of Malocclusion And Dentofacial Deformities 3rd Edition. New Delhi: Jaypee Brothers Medical Publishers.
[8] Rezalinoor, M. A., Kurniawan, F. K. D., Wibowo, D. (2017). Gambaran Tingkat Kebutuhan Perawatan Ortodonti Di SMPN 2 Takisung Berdasarkan Index of Orthodontic Treatment Need. Dentino (Jur. Ked. Gigi), 2(2); 188-193.
[9] Alatrach, A. B., Fayez, S. K., Osman, Esam. (2014). The Prevalence of Malocclusion and Orthodontic Treatment Need In A Sample Of Syrian Children. European Scientific Journal, 10(30); 1857 – 7881.
[10] Nofrizal, R., Maharani, C. V. (2023). Hubungan Tingkat Kebutuhan Perawatan Ortodonti Menggunakan Index Of Orthodontic Treatment Need (IOTN) Dengan Dental Aesthetic Index (DAI). JKGT, 5(1); 197-199. https://doi.org/10.25105/jkgt.v5i1.17122.

[11] Sutejo, I. R., Noveyani, A. E., Lukmawati, A. (2021). Pemberdayaan Petani Desa Candijati Dalam Pencegahan Covid-19 Dan Peningkatan Status Ekonomi Melalui Pembuatan Masker Jerami Aromaterapi. Jurnal Kreativitas Pengabdian Kepada Masyarakat (PKM), 5(1); 177-184. https://doi.org/10.33024/jkpm.v1i1.5404.

[12] Fatimatuzzahro, N., Prasetya, R. C. (2015). Peningkatan Kesehatan Gigi Dan Mulut Petani Kakao Kecamatan Bangsalsari. Universitas Jember: Fakultas Kedokteran Gigi Universitas Jember.

[13] Kiswaluyo, Budirahardjo., R, Sulistiyani, Misrohmasari., E. A. A, Putri., N. L. P. M. (2023). The Relationship Between Parental Support on Children Oral Health and Children Dental Caries in Agroindustrial Area of Jember. Jurnal Multidisiplin Madani (MUDIMA), 3(9); 1972-1977. https://doi.org/10.55927/mudima.v3i9.5249.

[14] Budiman, J. A., Sudiono, J. A., Amin, M. F., Ariefin, S. P. (2022). Pemeliharaan Kesehatan Gigi Dan Mulut Dalam Rangka Pencegahan Kelainan Maloklusi di Masa Pandemi COVID-19. Jurnal AKAL: Abdimas dan Kearifan Lokal, 3(1); 100-109. https://doi.org/10.25105/akal.v3i1.9754.

[15] Lubis, H. F., Laturiuw, H. P. (2018). Socioeconomic Status And Orthodontic Treatment Need Based On The Dental Health Component. Dental Jurnal, 51(3): 119–123. https://doi.org/10.20473/j.djmkg.v51.i3.p119-123.

[16] Proffit, W., Fields, H., Larson, B., Sarver, D. (2019). Contemporary Orthodontics. 6th ed. Philadelphia: Elsevier; 126−34.

[17] Anindita, P. S., Gosal, S., Ginting P. E. B. (2024). Prevalensi Maloklusi Pada Anak Usia 9−12 Tahun Di Daerah Pesisir Kecamatan Malalayang Kota Manado. e-GiGi, 12(1); 137-141. https://doi.org/10.35790/eg.v12i1.50363.

[18] Lydianna, T., Utari D. (2021). Pengaruh Kebiasaan Buruk Oral Terhadap Malrelasi Gigi Pada Anak Panti Asuhan Usia 7-13 Tahun. Insisiva Dental Journal: Majalah Kedokteran Gigi Insisiva, 10(2); 32-37. https://doi.org/10.18196/di.v10i2.12796.

[19] Graber, L. W., Vanarsdall, R. L., Vig, K. W. L., Huang, G. J. (2017). Orthodontics Current Principles And Techniques (6th ed). Missouri: Elsevier.

[20] Riyanti, E., Indriyanti, R., Primarti, R. S. (2018). Prevalensi Maloklusi Dan Gigi Berjejal Berdasarkan Jenis Kelamin Dan Umur Pada Anak-Anak Sekolah Dasar Di Bandung. Jurnal Pengabdian Kepada Masyarakat ,2(12).

[21] Anzarkuma, Indah S., Mulyani, E. Y., Idrus, Dudung A. (2014). Status Gizi Berdasarkan Pola Makan Anak Sekolah Dasar Di Kecamatan Rajeg Tangerang. Indonesian Journal of Human Nutrition, 1(2); 135-148.

[22] Andries, A. M., Anindita, P. S., Gunawan, P. N. (2021). Hubungan Antara Gigi Berjejal Dan Status Gizi Pada Remaja. e-GiGi, 9(1); 8-14. https://doi.org/10.35790/eg.9.1.2021.32308.

[23] Dimaisib, N. J., Duijster, D., Benzian, H., Heinrich, W. R., Homsavath, A., Monse, B., et al. (2018). Nutritional Status, Dental Caries, And Tooth Eruption In Children: A Longitudinal Study In Cambodia, Indonesia, And Lao PDR. BMC Pediatr, 18(300); 1-12. https://doi.org/10.1186/s12887-018-1277-6.

[24] Wijayanti, P., Krisnawati, Ismah N. (2014). Gambaran Maloklusi Dan Kebutuhan Ortodonti Pada Anak Usia 9-11 Tahun [serial online]. Jurnal PDGI, 63(1); 25-29.

[25] Aditya, M. Y., Baehaqi, M., Praptiningsih, R. S. (2015). Pengaruh Pengetahuan Orang Tua Tentang Ortodonsi Preventif Dengan Perilaku Pencegahan Maloklusi Pada Gigi Anak. ODONTO Dental Journal, 2(1). https://doi.org/10.30659/odj.2.1.46-50.

[26] Farani, W., Abdillah, M. I., (2021). Prevalensi Maloklusi Anak Usia 9-11 Tahun di SD IT Insan Utama Yogyakarta. Insisiva Dental Journal: Majalah Kedokteran Gigi Insisiva, 10(1); 26-31. https://doi.org/10.18196/di.v10i1.7534.

[27] Nahusona, D. R,, Sari, J. P. (2018). Tingkat Keparahan Maloklusi Pada Anak Usia 11-12 Tahun Dengan Menggunakan Indeks Handicapping Mal-occlusion Assesment Record: Penelitian Observasional Di Kecamtan Lalabata, Kabupaten Soppeng. Makassar Dent J, 7(2): 61-67.

[28] Wilar, L. R. (2014). Kebutuhan Perawatan Ortodonsi berdasarkan Index of Orthodontic Treatment Need Pada Siswa SMP Negeri 1 Tareran. Jurnal e-Gigi, 2(2). https://doi.org/10.35790/eg.2.2.2014.5035.