The Proportion of Overjet and Overbite Problems in Adolescents with Tension-Type Headache

Thalita Audi[1], Widya Kusumadewy[2*], Erwin Siregar[2]

1. Undergraduate Student, Faculty of Dentistry, Universitas Indonesia, Jakarta, Indonesia.
2. Department of Orthodontic, Faculty of Dentistry, Universitas Indonesia, Jakarta Pusat, Indonesia.

Abstract

An overjet and overbite beyond the normal limits can both increase the contraction of the masticatory muscle, which can be a cause of tension-type headache (TTH). TTH is the most common type of headache, and it may affect various aspects of the patient's quality of life. The aim of this study was to determine the proportion of these malocclusions among adolescents in the 11th grade at 81 Jakarta High School who suffered from TTH. **Methods:** Headache questionnaires were distributed to 324 students before guided interviews were conducted. Among them, 112 subjects were diagnosed with TTH, and they underwent an examination to measure their overjet and overbite using periodontal probes. **Results:** The results showed that 43.4% of subjects suffered from TTH, of which 40.2% had an overjet problem (26.8% had an excessive overjet, while 13.4% had an anterior cross bite) and 30.4% had an overbite problem, for example, a deep bite. **Conclusion:** The number of adolescents with TTH accompanied by overjet and overbite problems was fewer than adolescent with TTH who had a normal overjet and overbite.

Clinical article (J Int Dent Med Res 2017; 10(Special Issue): pp. 729-734)

Keywords: Tension-type headache, excessive overjet, anterior cross bite, deep bite.

Received date: 17 August 2017 **Accept date:** 19 September 2017

Introduction

Tension-type headache (TTH) is the most common type of headache, with a lifetime prevalence ranging between 30% and 78%.[1,2] Research conducted at 5 local hospitals in Indonesia showed that episodic and chronic TTH have the highest prevalence when compared to other types of headache.[3] However, studies concerning TTH are still lacking when compared to those concerning the other primary headaches.[4]

TTH is also prevalent among adolescents, with a prevalence ranging from 10% to 25%.[3] This type of headache can affect various aspects of daily life, which leads to it having a significant impact on the sufferer's quality of life.[5] The causes of TTH are multifactorial, with the known causes including ischemia and muscle contraction due to an imbalance in the stomatognathic system, for example, dental malocclusion.[6-10]

Corresponding author:
Widya Kusumadewy
Department of Orthodontic
Faculty of Dentistry, Universitas Indonesia.
E-mail: widy.dewi@gmail.com

In an anterior malocclusion state, an overjet and overbite beyond the normal limits have both been reported to increase the workload of the mastication muscles.[9] Additionally, prior research has reported that excessive muscle contractions play a significant role in the development of the pain pathways associated with TTH.[11] However, the exact mechanism of TTH remains unclear.[12]

Only a limited number of studies have so far been conducted on dental malocclusion and TTH in children and adolescents.[13,14] Ibrahim et al. and Buchanan et al. suggested that overjet and overbite problems are the two most common problems seen in subjects with TTH when compared to the other malocclusions.[14] In addition, a significant correlation has been reported between an overjet, overbite, and posterior cross bite and an increased risk of TTH.[14]

Therefore, this study was conducted to determine the percentage of students with TTH, general conditions of overjet, and overbite as well as the percentage of students with overjet and overbite problems that included excessive overjet, anterior cross bite, and deep bite with TTH in 11th grade at 81 Jakarta High School.

Methods

This was a population-based study that applied a cross-sectional design by recruiting all the subjects using total sampling methods. The study began with the distribution of headache questionnaires to all 11th grade studentswho attend 81 JakartaHigh School (n=324). Based on the personal data provided as well as the analysis of the answers given to the questionnaires, the included students were aged 15 to 17 years old, had permanent teeth complete until the second molars, and suffered with tension-type headache. Students who had present or previous orthodontic treatment, were diagnosed with other types of headaches by doctors, always experienced headaches during the menstrual period, and had a history of headache as a result of trauma to the maxillofacial region, head, or neck were excluded from the study. Based on the inclusion and exclusion criteria, 112 research subjects were selected to participate in the study.

The data concerningthe subjects' experiences of tension-type headache were collected through their recollections during guided interviews, while the subjects also answered headache questionnaires that had been adapted to reflect the International Classification of Headache Disorder. The research subjects then underwent a clinical examination of their overjet and overbite using periodontal probes with 1mm markings, parallel and perpendicular to the occlusal plane, calculated at the point of greatest difference, and reported to the nearest 0.5 mm. The examination results were divided into two major groups, subjects with overjet problem and subjects with normal overjet. The overjet problems included excessive overjet (if the value is more than 5 mm) and anterior crossbite (if the value is less than 0 mm), while the overbite problems includeddeepbite (if the value is more than 5 mm). Examination of each subject was recorded. Before the clinical examination, intraobserver and interobserver tests were conducted on 10% of subjects to ensure that the measurement was reliable.

Statistical analysis

A univariate data analysis was performed using SPSS software version 22.0. The data were processed to describe the frequency and proportion of each variable, and then presented in tabular form.

Results

The validity of the overjet and overbite examinations wastested using the Pearson product-moment correlation test. The result obtained was valid, with all the values of "r calculated" exceeding the value of "r table" (0.2785). Meanwhile, Cronbach's alpha test was used to test the reliability of the questionnaire, and the result was found to be reliable, with a Cronbach's alpha value > 0.60.

This study began with the distribution of informed consent forms and headache questionnaires to 324 students in 11th grade. After all personal data were collected and subjects were selected based on the inclusion criteria, 258 questionnaires were further analyzed. The results showed that 112 (43.4%) students suffered from TTH, and these students comprised the subjects of this research (Table 1).

Table 1. The frequency and proportion of tension-type headache among 11th grade students who attend 81 Jakarta High School

Headache Status	Total (N)	Proportion (%)
TTH	112	43.4%
Non-TTH	146	56.6%
Total	258	100%

From 112 research subjects, the number of female subjects was 74 (66.1%), which was almost two times higher than the 38 (33.9%) male subjects (Table 2). The overjet measurement results shown in Figure 1 showed that there were 45 (40.2%) subjects with an overjet problem, which included anterior crossbite in 15 subjects, or 13.4%, and excessive overjet in 30 subjects, or 26.8%. The average overjet value was 3 mm, and the lowest and highest were -1mm and 9mm, respectively.

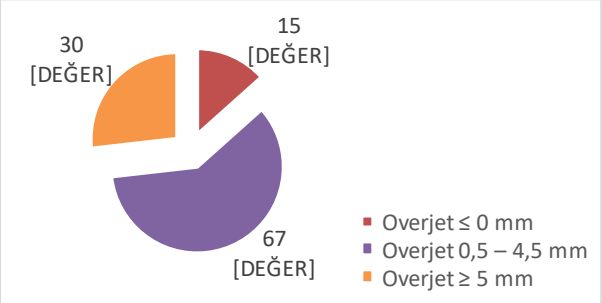

Figure 1. Proportion of the overjet measurement results in adolescents with tension-type headache who attend 81 Jakarta High School.

Table 2. Demographic characteristics of the research subjects by sex

Sex	Total (N)	Proportion (%)
Female	74	66.1%
Male	38	33.9%
Total	112	100%

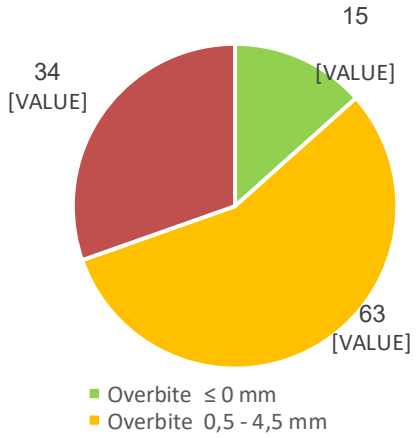

Figure 2. Proportion of the overbite measurement results in adolescents with tension-type headache who attend 81 Jakarta High School.

Figure 2 shows that overbite problems in the form of deep bite were identified in 34 subjects (30.4%). In addition, 15 subjects (13.4%) had open bite. The average overbite value was 3mm, and the lowest and highest were -10mm and 10mm, respectively.

Discussion

This study was conducted in October 2016 at 81 JakartaHigh School. The subjects who participated in the study were: (1) 11th grade students aged between 15 and 17 years old; (2) students who had complete permanent teeth until the second molars; and (3) students who experienced tension-type headache.

Based on the personal data collected from the initial 324 of 11th grade students, 66 students were not analyzed further due to their questionnaires reflecting the exclusion criteria, for example, the students were younger than 15 years old, had incomplete permanent teeth, had previously undergone orthodontic treatment or were presently receiving such treatment, or complained of always experiencing a headache during menstruation. During the course of the study, no students were found to have experienced a headache as a result of trauma to the maxillofacial region, head, or neck, while no students were found to have been diagnosed with another type of primary headache. Due to the inclusion and exclusion criteria, a total of 258 TTH questionnaires could ultimately be analyzed.

The subjects were recorded as experiencing TTH if they exhibited particular headache characteristics that corresponded to the diagnostic criteria for TTH found in the International Classification of Headache Disorder (ICHD)-3rd edition. According to the ICHD-3, the prevalence of TTH in the general population ranges between 30% and 78%.[1] In this study, the obtained proportion value was within that prevalence range reported by the ICHD. The result was also higher than the proportion of TTH previously reported in the general adolescent population, which ranges from 10% to 25%, with the associated risk factors including divorced parents, having few friends, depressive symptoms, pain in the neck and shoulders, and oromandibular dysfunction.[3]

The prevalence found in this study was higher than that reported by Kandil et al in adolescents aged 15 to 19 years old, which amounted to 12.7% and was found to be relatedto age, sleeping difficulties, and stress.[3,15] However, Ozge et al. suggested a higher proportion, namely 57.5% out of a total population of 1155 adolescents in Turkey.[16]

These differences in proportion are likely caused by (1) the variation and extensive

pathophysiology of TTH, which might be different from one individual to another; (2) the diverse characteristics of the studied population, both in terms of environmental factors and individual aspects; and (3) the research methods applied, including prevalence estimates, operational definitions, and diagnostic methods.

Stimulus from mental conditions, excessive local myofascial tissue contraction, or a combination of the two factors are believed to be most commonly responsible for inducing TTH.[17] Mental stress has been widely reported to be the most common trigger, although some studies have suggested that it was a non-specific factor in the pathophysiology of TTH.[18] In this study, almost 50% of subjects experienced TTH that was likely influenced by stress factors related to a number of issues, including the difficulty level ofschool curriculum and pressure to achieve good grades and rankings.

Most of the 11th grade students who attend 81 Jakarta High School also receive additional tutoring to help them maintain their grades and actively join various organizations, which might influence their mental state and body fatigue. The information provided by teachers, guidance counselors, and parents with regard to achieving an offer to study at a desired university was likely to be a stimulus, too. This notion is supported by the work of Baldwin et al.,who stated that difficult lessons can cause stress in high school students due to the pressure they experience in relation to achieving good marks.[19]

The demographic characteristics of the subjects as presented in Table 2 showed that the proportion of female students who experienced TTH is nearly double that of male students. This result corresponds with the findings of Kandil et al., who reported that females aged 15 to 19 years experienced TTH in greater numbers than males of the same age, with ratio of 3.2:1.[15] The differences between the two genders are likely caused by the role of hormonal imbalance, which is greater in females, although female students who always experience headaches during their menstrual period were excluded from the present study. The decision to exclude those particular female students was made in order to ensure that TTH, which occurs in both sexes, could be considered without prejudice, which was not achieved in previous studies. However, the results indicate that female adolescents still have a higher likelihood of experiencing headaches, which may be due to their greater hormonal fluctuation and more unstable psychological condition, regardless of their menstrual period.

This assumption is supported by the outcomes of Lambourne's research, which showed that after puberty or over the age of 12 years, TTH is reported to be more common in females due to their different hormonal imbalance and emotional state, which is arguably more sensitive to anxiety and depression.[14] In addition, Aliani stated that the estrogen hormone in females can have an impact on the nervous system by sensitizing the peripheral nerve pain at the myofascial tissues and thereby producing TTH.[20]

Nevertheless, several researchers, including Hagen et al., Unalp et al., and Katsawara et al., have argued that there is no significant difference in the proportion of TTH between the two sexes.[15] Therefore, the role of hormones in the pathophysiology of TTH remains unclear. Indeed, although some studies have shown an association between hormonal factors and TTH, no definite consensus has been reached regarding the role of hormones in the pathophysiology of TTH.[21]

After the 258 questionnaires had been analyzed, 112 students who experienced TTH were identified. They were referred to as the subjects of this research, and they underwent a clinical examination to measure their overjet and overbite. Figure 1 shows that 40.2% of subjects exhibited overjet problems, which includes the proportion of excessive overjet and anterior crossbite. The results of a study conducted in New York by Buchanan et al. suggested a higher proportion, that is, 60% of 50 adolescents aged 8 to 16 years allegedly suffered from TTH.[14]

Ibrahim et al. conducted a similar study among 600 Jordanian adolescents, and they also obtained a higher result (48%).[13] These differences in terms of the proportion might occur due to several reasons, namely (1) the variation in the characteristics of the subjects, including genetics and bad habits like thumb sucking or mouth breathing; (2) the methods used in each study, for example, the inclusion-exclusion criteria; and (3) the overjet and overbite measurement methods that were used.

An overjet measurement equal to or greater than 5 mm has been reported to significantly induce a hyper-contraction of masticatory muscles.[14,22] In this study, the

proportion of subjects who were found to have an excessive overjet was 26.8%. This value is far greater than the proportion reported by Komazaki et al. (9.4% of Japanese adolescents aged 12-15 years who experienced headaches). However, Buchanan et al. found higher proportions, i.e., 40%, of adolescents who experienced TTH with an excessive overjet.[14]

Ibrahim et al. also reported a higher proportion than in this study, which was 48%.[13] An overjet greater than the normal range may affect other masticatory systems by requiring more effort to be expended in order to rebalance the system so it can work properly. If the condition is left untreated for a long time, it may lead to muscle disorder and hence predispose the patient to TTH.

This supposition is supported by the work of Zimmer et al., who stated that an overjet equal to or greater than 5 mm can generate muscle disorder, which is expected to result from the lack of incisor guidance, the need for larger mandibular movement, and stress placed on the masticatory muscle.[22] Individuals with an excessive overjet also exhibit a tendency to regularly move the lower jaw in an anterior direction, which establishes a double occlusion and leads to an increased workload on the masticatory muscles that play a major role in TTH.[9,14]

In this research, the proportion of subjects with an anterior crossbite was found to be 13.4%. This result is lower than the results reported by Buchanan et al. and Ibrahim et al. (18% and 28%, respectively).[17,18] The low proportion of this malocclusion was likely due to the low number of students with that abnormality. Proffit stated that an anterior crossbite, which is generally found in individuals with Class III malocclusion, is rare among the general population when compared to other malocclusions.

An imbalance in the working of the masticatory system caused by an overjet problem is likely to result in physiological changes that lead to the manifestation of TTH. Buchanan et al. and Ibrahim et al., also concluded that overjet problems, whether excessive overjet or anterior crossbite, were significantly associated with an increased risk of TTH.[17,18]

Some studies has indicated that a deep bite equal to or more than 5 mm can cause a retrusive position of the mandibular that is associated with muscle disorders, which likely induces TTH. In this study, the percentage of adolescents with TTH who had an overbite problem in the form of a deep bite was 30.4%. This percentage is higher than the results of Komazaki et al. (8.2%) and Buchanan et al. (34%).[18] Deep bite can potentially cause an imbalance in the masticatory system and can induce TTH. Buchanan et al. and Ibrahim et al. also concluded that deep bite is significantly associated with an increased risk for TTH.[20,21]

Open bite (overbite ≤ 0 mm) was not included in this study based on Buchanan et al.'s finding that open bite is not significantly associated with an increased risk for TTH; however, during the clinical examinations, 13.4% of students with open bite suffered from TTH. This percentage is much higher than study reported by Komazaki et al. (0.4%) but lower than Buchanan et al.'s result (20%).[17] Cruz et al. claimed that open bite may cause an unstable position of the mandibula that is not occluded with the maxilla; thus, it is associated with muscle disorders and can stimulate TTH.[9]

An overjet or overbite beyond the normal limits may have an influence on TTH due to excessive muscle contractions, which might cause TTH, but not all subjects who experienced this type of headache had both types of malocclusions. This statement is supported by the percentage of subjects with a normal overjet (59.8%) and an overbite (56.2%) in this study. Both results are higher than Buchanan et al. reported (40%).[13]

Multifactorial causes and the fact that overjet and overbite are still included in the various risk factors of TTH should be considered, although the inclusion and exclusion criteria were established to eliminate the possibility of other risk factors being involved. The differences in pain and muscle tolerance limits for an abnormal overjet or overbite can also present a different manifestation in each individual.[9]

Conclusions

Based on the findings of the research, it can be concluded that among 258 11th grade students at 81 Jakarta High School, 112 students, or 43.4%, experienced tension-type headaches. Subsequently, 40.2% of the 112 subjects had overjet problems, including excessive overjet (26.8%) and anterior crossbite

(13.4%). The percentage of subjects with an overbite problem in the form of deep bite was 30.4%. The percentage of subjects with open bite was 13.4%.

Based on these results, the number of subjects with Tension-type Headaches (TTH) whose overjet and overbite problems were categorized as malocclusions was still lower than the number of subjects with TTH who had normal overjet and overbite.

Acknowledgements

We would like to thank all the staff of 81 Jakarta High School, who were all very helpful in accomplishing this study. Additionally, we wish to thank to Dr. Yetty Ramli, Sp.S(K), who provided some specialist neurological advice.

This study was conducted under the supervision of the Department of Orthodontics, Universitas Indonesia.

The publication of this manuscript is supported by Universitas Indonesia.

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