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Aesthetic components of index of orthodontic treatment need in Serbian adolescents

Estetska komponenta indeksa potrebe za ortodontskom terapijom kod adolescenata u Srbiji

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Abstract

Background/Aim. The biggest motivating factor for undertaking orthodontic treatment is poor dental aesthetics as a consequence of occlusal abnormalities. The aim of this study was to determine the need for orthodontic treatment, based on the aesthetic components of the Index of Orthodontic Treatment Need (IOTN), to compare the degree of aesthetic component of IOTN and the subjective perception of individuals about their dental aesthetics, but also to compare their evaluation of the aesthetic component of IOTN in comparison with the evaluation of the therapist. **Methods.** The study was conducted on a sample of 316 students aged 15–19 years who did not have an orthodontic treatment prior to the survey. The research was carried out using the IOTN. The IOTN consists of dental and aesthetic components based on which the need for therapy was determined. The aesthetic component of the index was noted by the therapist (specialist of orthodontics) as well as the subject. **Results.** According to the grades of subjects, the need for orthodontic treatment was present in 0.38% of male subjects and 2% of female subjects. According to the evaluations of the therapists, the need for orthodontic treatment was present in 7.52% of male subjects and 8% of female subjects. Observing all subjects, the need for orthodontic treatment was present in 0.63% of subjects, and according to the therapist, the need for orthodontic treatment was present in 7.59% of subjects. The mentioned difference was statistically significant. **Conclusion.** Obtained results show that there is a significant difference in evaluation of dental aesthetics and the need for orthodontic treatment between the subjects and therapists. This can be a cause for concern because patients who are not aware of their orthodontic abnormality can limit the need for further treatment.

Key words:
adolescent; aesthetics, dental; malocclusion; orthodontics, corrective.

Apstrakt

Uvod/Cilj. Najveći motivacioni faktor za preduzimanje ortodontske terapije je loša dentalna estetika, nastala kao posledica okluzalne nepravilnosti. Cilj rada bio je da se odredi potreba za ortodontskom terapijom na osnovu estetske komponente Indeksa potrebe za ortodontskom terapijom (IOTN), da se uporedi stepen estetske komponente IOTN-a i subjektivne percepcije ispitanika o njegovoj dentalnoj estetici, kao i da se uporedi evaluacija estetske komponente IOTN ispitanika u odnosu na terapeuta. M**etode.** Istraživanje je sprovedeno na uzorku od 316 učenika, uzrasta 15–19 godina koji pre istraživanja nisu bili ortodontski lečeni. Na osnovu IOTN izvršena je procena potrebe za ortodontskom terapijom. Indeks IOTN sastoji se iz dve komponente, dentalne i estetske. Estetska komponenta indeksa zabeležena je od strane terapeuta, specijaliste ortopedije vilica, kao i od samog ispitanika. **Rezultati.** Prema ocenama ispitanika potreba za ortodontskom terapijom bila je prisutna kod 0.38% ispitanika muškog pola, i 2% ispitanika ženskog pola. Prema ocenama terapeuta, potreba za ortodontskom terapijom bila je prisutna kod 7.52% ispitanika muškog pola i 8% ispitanika ženskog pola. Posmatrajući sve ispitanike, potreba za ortodontskom terapijom bila je prisutna kod 0.63% ispitanika, a prema mišljenju terapeuta potreba za ortodontskom terapijom bila je prisutna kod 7.59% ispitanika. Pomenuta razlika je bila statistički značajna. **Zaključak.** Dobijeni rezultati ukazuju na to da postoji značajna razlika u pogledu zahteva za estetiku zuba i potrebe za ortodonstskom terapijom između ispitanika i terapeuta. To može biti razlog za zabrinutost, jer pacijenti koji nisu svesni svoje ortodontske nepravilnosti, mogu ograničiti potrebu za daljim lečenjem.

Ključne reči:
adolescenti; estetika, stomatološka; malokluzija; ortodoncija, korektivna.

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Introduction

Malocclusion represents a variation regarding the normal dental and skeletal characteristics [1]. Disturbed facial appearance, as a direct consequence of occlusal abnormalities, is the most common reason why patients require orthodontic treatment.

The patient's perception of the impact of dental variations on his/her self-image depends on many factors, such as religious, social, cultural, and others. Some patients are not even aware of their irregularities, while others complain of a lot fewer irregularities [2–4]. As a result, numerous indices have been developed in order to determine the need for treatment more objectively. The purpose of most occlusal and orthodontic indexes is to assess the anatomical characteristics of malocclusion without assessing the patient's subjective perception of orthodontic anomalies and their impact on the self-esteem and quality of life of the patient. The first index that includes the patient's perception of dental aesthetics is the Index of Orthodontic Treatment Need (IOTN) (its aesthetic component).

In 1989, Brook and Shaw [5] described the index of the need for orthodontic treatment – IOTN, which consists of two components: Dental Component (DHC) and Aesthetic Component (AC).

DHC includes various occlusal traits divided into five categories (degrees) depending on the severity. The first and second degree do not indicate the need nor a slight need for orthodontic treatment, the third degree indicates the borderline need for therapy, and the fourth and fifth degree indicate a great need for orthodontic treatment [2, 3, 6–9]. While determining this component of the index, not every alteration is marked, but the worst determined occlusal trait is the one that defines the highest degree of the need for therapy [1].

The aesthetic component of the index consists of ten intraoral photographies depicting various malocclusions graded according to aesthetic appeal – from the most attractive to the most unattractive dental look [2, 3, 6, 7]. By using this index component, it can be evaluated how much facial appearance is disturbed with the present orthodontic irregularity.

Several studies have shown the validity of the IOTN. It is a reliable, reproducible, accurate, and efficient way to subjectively and objectively assess treatment needs [5, 10, 11].

The greatest limitations of AC of the IOTN are that it is subjective and it does not measure occlusal traits. AC of the IOTN assesses the aesthetic aspects of the malocclusion only in the frontal view and emphasizes the subjective nature of it [12].

There is also a modified form of this index that simplifies identifying people in the need of treatment. The modified IOTN has two categories – definite need for treatment and no definite need for treatment [12, 13].

In many countries, studies on the use of the IOTN are conducted, for example, in Saudi Arabia [14, 15], Nigeria [16, 17], France [18], Italy [19], Iran [20], Spain [21], and Serbia [22].

The aim of this study was to determine the need for orthodontic treatment based on AC of the IOTN, to compare the degree of AC of the IOTN and subjective perception of individuals about their dental aesthetics, but also to compare the evaluation of an individual about AC of the IOTN in comparison with the evaluation of a therapist.

Methods

The study included 316 army students (226 boys and 50 girls) of the Military Gymnasium in Belgrade, Serbia. Students were 15–19 years old, and up to the moment of the research, they were not subjected to orthodontic treatment. Before inclusion, written informed consent was obtained from each participant. Students were examined as part of the Oral Health project of the Military Medical Academy in Belgrade that had been approved by the institutional Ethics Committee.

Clinical examination was performed by one dentist, a specialist in orthodontics, at the Clinic for Dentistry, Military Medical Academy. During the examination of students, AC of the IOTN was noted by the therapist as well as by each student.

AC of the IOTN consists of ten intraoral photos that are graded according to the aesthetic appeal of the teeth. The first photo represents the most attractive and the tenth the least attractive degree. The aesthetic scale is divided into three categories, according to the need for treatment: the first – no need for therapy (Figure 1, 1–4); the second – borderline required therapy (Figure 1, 5–7); the third – great need for therapy (Figure 1, 8–10).

Color photographs were used for the clinical determination of the index. The attractiveness of the teeth was rated according to AC, and the grade was the number that standed next to the photo. Students were shown an AC of 10 photographs, and then a photograph most similar to their tooth appearance was selected.

During the examination, the appearance of the students' teeth was compared with the photos and classed in one of the suitable degrees, both by the therapist and by the subjects as well.

Students with cognitive disorders, chronic illnesses, craniofacial anomalies, and students who had previously undergone orthodontic therapy were excluded from the study. Patients who were not given their consent or were undergoing orthodontic therapy were also excluded from the study.

Statistical analysis

For statistical analysis of the data, software IBM SPSS Statistics 21.0 for Windows was used. The values in which $p < 0.05$ were taken as statistically significant.

Data were evaluated by using the χ^2-test, Mann-Whitney test, Kolmogorov-Smirnov test, and Spearman's correlation.

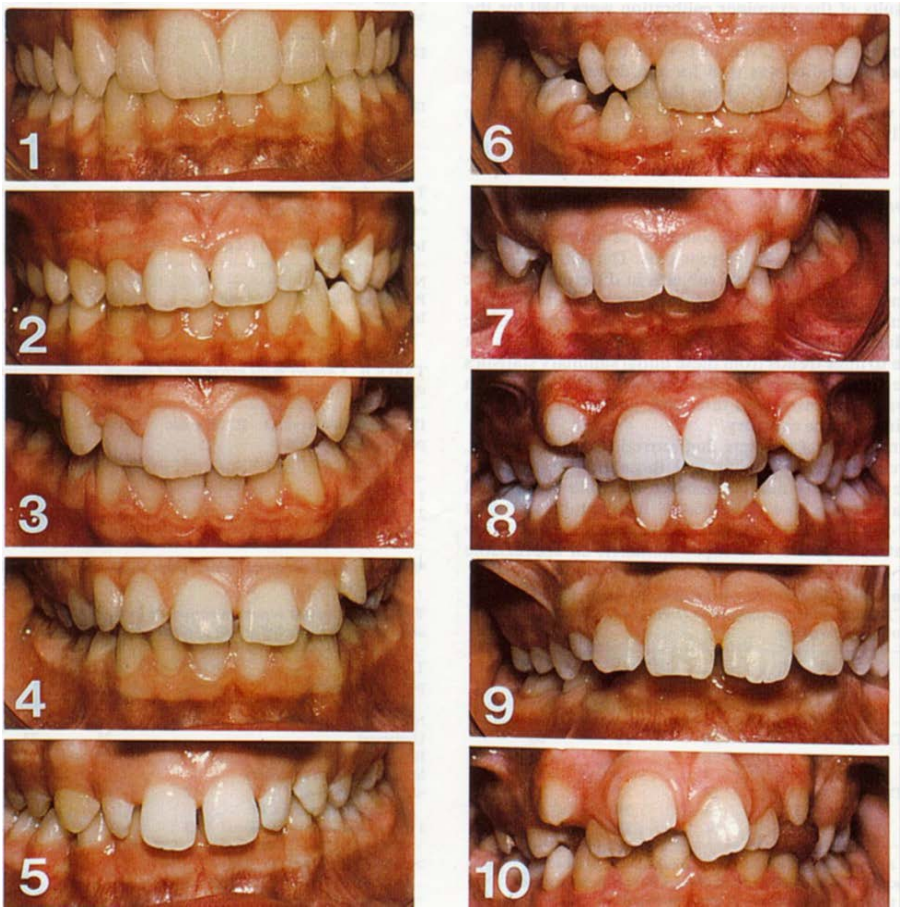

Fig. 1– Aesthetic component of the Index of Orthodontic Treatment Need (IOTN): 1-4 – no need for therapy; 5-7 – borderline required therapy; 8-10 – great need for therapy.

Results

The need for orthodontic treatment based on subjects' evaluation of AC of the IOTN is shown in Table 1. According to AC of the IOTN, 95.25% of subjects had no need for orthodontic treatment (grades 1-4), 4.11% had borderline need (grades 5-7), and 0.63% had a great need for orthodontic treatment (grades 8-10).

Table 1

Distribution of subjects by gender and the need for orthodontic treatment (assessment of all subjects)

Need for orthodontic treatment	Subjects, n (%)		
	male	female	total
No	254 (95.49)	47 (78.00)	301 (95.25)
Borderline	11 (4.14)	2 (14.00)	13 (4.11)
Great	1 (0.38)	1 (8.00)	2 (0.63)
Total	266 (100.00)	50 (100.00)	316 (100.00)
Significance	$\chi^2 = 1.766$; Df = 2; $p = 0.414$		

There were no statistically significant differences between the sexes during the AC grading within the IOTN.

The need for orthodontic treatment based on evaluation of AC of the IOTN by the therapist is shown in Table 2. According to the therapist's evaluation of AC of the IOTN, 83.23% of subjects had no need for therapy (grades 1-4), 9.18% had borderline need (grades 5-7), while 7.59% of subjects had a great need for orthodontic treatment (grades 8-10).

Table 2

Distribution of subjects by gender and the need for orthodontic treatment(assessment of therapist)

Need for orthodontic treatment	Subjects, n (%)		
	male	female	total
No	224 (84.21)	39 (78.00)	263 (83.23)
Borderline	22 (8.27)	7 (14.00)	29 (9.18)
Great	20 (7.52)	4 (8.00)	24 (7.59)
Total	266 (100.00)	50 (100.00)	316 (100.00)
Significance	$\chi^2 = 1.713$; Df = 2; $p = 0.425$		

There were statistically significant differences in determining AC of the IOTN between the subjects and the therapist.

If we consider all subjects (n = 316), the grades of subjects and the therapist were in a statistically significant medium-strong positive correlation (Spearman's correlation coefficient: R = 0.463; $p = 000$).

By observing all subjects, the average grade of subjects was 2.21, while the average grade of the therapist was 3.00. This difference was statistically significant.

By observing all subjects, 0.63% of them needed orthodontic treatment, while according to the therapist, 7.59% of subjects needed orthodontic treatment. There was a statistically significant difference (Table 3).

Table 3
Distribution of all subjects by the need for orthodontic treatment (assessment of all subjects and therapist)

Need for orthodontic treatment	Subjects n (%)	Therapist n (%)
No	301 (95.25)	263 (83.23)
Borderline	13 (4.11)	29 (9.18)
Great	2 (0.63)	24 (7.59)
Total	316 (100.00)	316 (100.00)
Significance	$\chi^2 = 27.271$; Df = 2; $p < 0.001$	

If we consider only male subjects (n = 266), the grades of participants and the therapist were in a statistically significant medium-strong positive correlation (Spearman's correlation coefficient: R = 0.452; $p < 0.001$).

The average grade of male subjects was 2.20, while the average grade of the therapist was 3.00. This mentioned difference was statistically significant.

According to the male subjects, 0.38% of them needed orthodontic treatment, while according to the therapist, 7.52% of subjects needed orthodontic treatment. There was a statistically significant difference (Table 4).

Table 4
Distribution of male subjects by the need for orthodontic treatment (assessment of male subjects and therapist)

Need for orthodontic treatment	Subjects n (%)	Therapist n (%)
No	254 (95.49)	224 (84.21)
Borderline	11 (4.14)	22 (8.27)
Great	1 (0.38)	20 (7.52)
Total	266 (100.00)	266 (100.00)
Significance	$\chi^2 = 22.740$; Df = 2; $p < 0.001$	

If we look at the female subjects (n = 50) , the grades of the participants and the therapist were in a statistically significant correlation (Spearman's correlation coefficient: R = 0.530; $p < 0.001$).

The average grade of female subjects was 2.28, while the average grade of the therapist was 3.00. This mentioned difference was statistically significant.

According to the female subjects, 2% of subjects needed orthodontic treatment, while according to the therapist, 8.00% of subjects needed orthodontic treatment. There was a statistically significant difference (Table 5).

Table 5
Distribution of female subjects by the need for orthodontic treatment (assessment of female subjects and therapist)

Need for orthodontic treatment	Subjects n (%)	Therapist n (%)
No	47 (94.00)	39 (78.00)
Borderline	2 (4.00)	7 (14.00)
Great	1 (2.00)	4 (8.00)
Total	50 (100.00)	50 (100.00)
Significance	$\chi^2 = 5.322$; Df = 2; $p = 0.070$	

Discussion

In recent years, the demand for orthodontic treatment, together with enhanced general awareness about aesthetics, has increased in many countries. In our country, children with small aesthetic imperfections and children with serious occlusal anomalies have the same right for orthodontic treatment. Introduction of indexes in orthodontic practice would eliminate the defects of traditional orthodontic diagnosis, which is subjective, and priority should be given to patients in whom therapy is necessary [23].

Besides patients' appearance, psychosocial circumstances significantly affect the determination of the need for orthodontic treatment. Therefore, it is difficult to determine just based on the analysis of plaster models and X-rays for whom the therapy is necessary and for whom it is not [3]. One of the main reasons why patients require orthodontic treatment is the reduction of psychosocial problems related to the appearance of the teeth and face. Not only are these problems aesthetic, but they can also significantly affect the quality of life [3]. It has been confirmed by some studies in Spain that the aesthetic appearance of teeth and the smile significantly affects patients' self-confidence, especially in the student population [24].

According to this survey, 8% of subjects had a great need for orthodontic treatment based on the analysis of AC of the IOTN with a significant difference in the assessments of the subjects and the therapist. Similar to our results, Janošević et al. [22] found out that 15.3% of subjects had malocclusions that needed treatment from an aesthetic viewpoint.

As part of research among children aged 9 to 12 years in France, Souames et al. [18] gave similar assessments based on the analysis of AC of the IOTN. According to that study, 7% of children had a great need for orthodontic treatment. There were no significant differences in the aesthetic evaluation between boys and girls.

Our study showed a significant difference between the grades of the subjects and the therapist, which was also the case with Nobile et al. [19].

Nobile et al. [19] conducted a study in Italy among children aged 11 to 14 years in which they compared AC of the index grades between the examiner and the examined children. Therefore, they obtained the following results: the therapist found that therapy was necessary for 8.6% of subjects, while subjects found that therapy was necessary for 3.2% of subjects. Based on these results, they came to a conclusion that the therapist's expert opinion is significantly more critical than the views of subjects concerning the disruption of the face aesthetic with present orthodontic abnormalities.

Same as Nobile et al. [19], Manzanera et al. [21] and Hedayati et al. [20] found reduced need for orthodontic treatment based on the analysis of AC of the IOTN.

Contrary to our study, a study in Shiraz found a slightly statistical correlation between the grades of subjects and examiners. The aim of that study was to assess the need for orthodontic treatment in children aged 11 to 14 years. Subjects were assessed based on AC of the IOTN, according

to which 4.11% of students had a great need for orthodontic treatment. Therapists also gave similar ratings according to which therapy was necessary for 6.21% of students. Their results showed that the need for orthodontic treatment was reduced, and most of the students were in the category of the little need for therapy [20].

Orthodontic treatment depends on the perception of the therapist but also on the perception of the patient. The perception of the patient and the actual need for orthodontic treatment helps in treatment planning. The patient's assessment for orthodontic treatment need is not always in correlation with the professional assessment. This was determined by Hassan [14], Kolawole et al. [16], Aikinis et al. [17], Hamdan [25], and Ousehal et al. [26].

While conducting research on subjects 12 to 18 years old on the territory of Nigeria, Aikinis et al. [17] noticed a significant difference in the rankings of the attractiveness of occlusion between the patients and the therapist. Based on the perception of the therapist, 17.6% of subjects had a great need for therapy. In patients' perception, 6.5% of subjects had a great need for therapy. Age and gender did not have an impact on assessing the need for orthodontic therapy [17].

Moreover, Soh and Sandham [27] found no correlation between the subjects and the therapist. They studied Asian male army recruits aged 17–22 years. The subjects perceived dental aesthetics differently from the therapist, which is similar to that of the present study. As in our study, men were generally more satisfied with their dental appearance and less likely to perceive the need for orthodontic treatment in order to correct their malocclusion.

This lack of understanding of the nature of malocclusion and its consequences suggests promoting further knowledge and awareness of malocclusion.

A significant correlation in grades for AC of the IOTN of the therapist and subjects was found by Albarakati et al. [15], Siddiqui et al. [28], and Ghijselings et al. [29].

Siddiqui et al. [28] conducted a study on this index on children aged 16 to 25 years and found a significant positive relation between the perceptions of the therapists and patients. Compared with the children in younger age groups, patients with the increase in the average age must be more aware of their aesthetic needs [24].

Another study in which patients from 17 to 24 years were tested showed that patients were less critical in assessing the need for orthodontic treatment compared to therapists. In assessing AC, therapists are significantly associated with the real need for therapy, while the aesthetic assessment of the subjects does not affect so much the real need for therapy as gender and personality traits [30].

Based on the therapist's assessment, Cai et al. [30] have established that the need for therapy is present in 32% of subjects, and only 11% of subjects think that orthodontic therapy is necessary. In that study, as in ours, the opinion of young people about the aesthetic appearance of their teeth differs from the opinion of the therapists. They do not have a realistic view of their appearance and are unable to seriously understand their orthodontic irregularity. Before starting treatment, it is important to explain in detail to patients their condition and why further therapy is needed. This improves communication between the patient and the therapist, better understanding, and better results are achieved in the treatment.

In the research of Cai et al. [30], the influence of gender and personality traits on the subjective perception of the AC was also assessed. Similar to our results, it was concluded that young Chinese women are more critical about dental aesthetics than men, and emotionally introverted people are more critical when their dental aesthetics is concerned [30, 31].

Some research has shown that even younger children have a rational view on the aesthetics of teeth and the need for orthodontic treatment. However, some authors believe that AC should not be used in children with mixed dentition because some orthodontic irregularities are often corrected during the period of growth and development or after breaking bad habits. Just for this reason, high rating values for the need for orthodontic treatment occur if AC is used in children with mixed dentition [18]. Nevertheless, current trends toward earlier initiation of the therapy justify the fact that the IOTN is also used in younger children.

The correct identification of patients who need orthodontic treatment from the early years of life allows interceptive treatments so that the increase in the severity of disorders and the need for more complex and expensive corrective orthodontic treatments is prevented [32].

If the patient's understanding of the need for treatment or the aesthetic classification is not the same as the therapist's one, it can pose a problem in the sense of the constraints of the need for therapy, or it may complicate the therapy itself [28, 33]. In order to ensure patient satisfaction and efficient orthodontic treatment, the perception of the patient, not just the professional assessment of the therapist, must be taken into consideration. A good correlation between self-perception and the real need for therapy indicates that patients are able to understand their clinical condition.

Conclusion

The obtained results showed that subjects did not have quite a rational view about the aesthetics of the teeth. They were not aware of the seriousness of orthodontic irregularities and the need for orthodontic treatment.

Before starting therapy, patients need to explain in detail the real need for orthodontic therapy. A better understanding of the patient has a positive effect on the goals of the treatment, reduces the likelihood of compromised outcomes of the treatment, and guarantees better results.

Using the IOTN, it is possible to estimate the need for orthodontic therapy considering dental aesthetics and AC of orthodontic anomalies. Due to the high prevalence of orthodontic irregularities, it would be important to introduce the use of this index in clinical practice in order to determine the priorities for the treatment and allocate the resources of dental health care correctly.

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R E F E R E N C E S

1. *Špalj S, Katalinić A, Varga S, Radica N*. Ortodontski priručnik. Rijeka: Medicinski fakultet Sveučilišta u Rijeci; 2012.
2. *Mitchell L*. An introduction to orthodontics. New York: Oxford University Press; 1998.
3. *Proffit RW, Fields WH, Sarver MD*. Contemporary orthodontics. 4th ed. St Louis: Mosby; 2007.
4. *Grzywacz I*. Orthodontic treatment needs and indications assessed with IOTN. Ann Acad Med Stetin 2004; 50(1): 115–22. (Polish)
5. *Brook PH, Shaw WC*. The development of an index of orthodontic treatment priority. Eur J Orthod 1989; 11: 309–20.
6. *Graber MT, Vanarsdall LR, Vig WLK*. Orthodontics: current principles and techniques. 4th ed. St Louis: Mosby; 2005.
7. *Millet D, Welbury R*. Orthodontics and paediatric dentistry. London: Harcourt Publishers Limited; 2000.
8. *Torkan S, Pakshir HR, Fattahi HR, Oshagh M, Momeni Danaei S, Salehi P,* et al. An Analytical Study on an Orthodontic Index: Index of Complexity, Outcome and Need (ICON). J Dent (Shiraz) 2015; 16(3): 149–55.
9. *Vishnoi P, Shyagali TR, Bhayya DP*. Prevalence of Need of Orthodontic Treatment in 7-16-Year-Old School Children in Udaipur City, India. Turk J Orthod 2017; 30(3): 73–7.
10. *Cooper S, Mandall NA, DiBiase D, Shaw WC*. The reliability of the index of orthodontic treatment need over time. J Orthod 2000; 27(1): 47–53.
11. *Younis JW, Vig KW, Rinchuse DJ, Weyant RJ*. A validation study of three indexes of orthodontic treatment need in the United States. Community Dent Oral Epidemiol 1997; 25(5): 358–62.
12. *Borzabadi-Farahani A*. An overview of selected orthodontic treatment need indices In: *Naretto S*. editor. Principles in Contemporary orthodontics. Rijeka: InTech 2011. p. 215–36.
13. *Richmond S, Shaw WC, Stephens CD, Webb WG, Roberts CT, Andrews M*. Orthodontics in the general dental service of England and Wales: A critical assessment of standards. Br Dent J 1993; 174(9): 315–29.
14. *Hassan AH*. Orthodontic treatment needs in the western region of Saudi Arabia: a research report. Head Face Med 2006; 2: 2.
15. *Albarakati SF*. Self-perception of malocclusion of Saudi patients using the aesthetic component of the IOTN index. Park Oral Dent J 2007; 27(1): 45–52.
16. *Kolawole KA, Otuyemi DE, Jeboda SO, Umwehi AA*. Awareness for malocclussion and desire for orthodontic treatment need in 11-14-year-old Nigerian schoolchildren and their parents. Aust Orthod J 2008; 24(1): 21–5.
17. *Aikinis EA, DaCosta OO, Onyeaso CO, Isiekwe MC*. Self-perception of malocclusion among Nigerian adolescentes using the aesthetic component of the IOTN. Open Dent J 2012; 6: 61–6.
18. *Souames M, Bassigny F, Zenati N, Riordan PJ, Boy-Lefevre ML*. Orthodontic treatment need in French schoolchildren: an epidemiological study using the Index of orthodontic treatment need. Eur J Orthod 2006; 28(6): 605–9.
19. *Nobile CG, Pavia M, Fortunato L, Angellio IF*. Prevalence and factors related to maloclusion and orthodontic treatment need in children and adolescentes in Italy. Eur J Public Health 2007; 17(6): 637–41.
20. *Hedayati Z, Fattahi HR, Jahromi SB*. The use of index of orthodontic treatment need in an Iranian population. J Indian Soc Pedod Prev Dent 2007; 25(1): 10–4.
21. *Manzanera D, Moutiel-Company JM, Almerich-Silla JM, Gandia JL*. Orthodontic treatment need in spanish schoolchildren: an epidemiological study using the Index of orthodontic treatment need. Eur J Orthod 2009; 31(2): 180–3.
22. *Janošević P, Stošić M, Janošević M, Radojičić J, Filipović G, Čutović T*. Index of orthodontic treatment need in children from the Niš region. Vojnosanit Pregl 2015; 72(1): 12–5.
23. *Đorđević J, Šćepan I, Glišić B*. Procena saglasnosti i korelacija tri okluzalna indeksa u određivanju potrebe za ortodontskim lečenjem. Vojnosanit Pregl 2011; 68(2): 125–9.
24. *Bellot-Arcis C, Montiel-Company JM, Pinho T, Almerich-Silla JM*. Relationship between perception of malocclusion and the psychological impact of dental aesthetics in university students. J Clin Exp Dent 2015; 7(1): e18–e22.
25. *Hamdan AM*. The relationship between patient, parent and clinician perceived need and normative orthodontic treatment need. Eur J Orthod 2004; 26(3): 265–71.
26. *Ousehal L, Lazrak L, Serrhini I, Elquars F*. Evaluation of facial esthetics by a panel of professionals and a lay panel. Int Orthod 2011; 9(2): 224–34.
27. *Soh J, Sandham A*. Orthodontic treatment need in Asian adult males. Angle Orthod 2004; 74(6): 769–73.
28. *Siddiqui TA, Shaikh A, Fida M*. Agreement between orthodontist and patient perception using Index of orthodontic treatment need. Saudi Dent J 2014; 26(4): 156–65.
29. *Ghijselings I, Brosens V, Willems G, Fieuws S, Clijmans M, Lemieve J*. Normative and self-perceived orthodontic treatment need in 11-to 16-year-old children. Eur J Orthod 2014; 36(2): 179–85.
30. *Cai Y, Du W, Lin F, Ye S, YeY*. Agreement of young adults and orthodontists on dental aesthetics & influencing factors of self-perceived aesthetics. BMC Oral Health. 2018; 18(1): 113.
31. *Yin L, Chen WJ, Yu XZ, Yu J, Fang L, Zhou B*, et al. A survey of perception differences of malocclusion between 16 to 22-year-old young adults and orthodontists. Hua Xi Kou Qiang Yi Xue Za Zhi 2011; 29(2): 153–6, 160. (Chinese)
32. *Cruz Lopez MF, Gutierrez Rojo MF, Gutierrez Rojo JF, Rojas Garcia AR*. Comparison between the ICON index and the aesthetic component of the IOTN to determine the need for orthodontic treatment. Rev Mex Ortodon. 2017; 5(1): e10–3.
33. *Alhummayani FM, Taibah SM*. Orthodontic treatment needs in Saudi young adults and manpower requirements. Saudi Med J 2018; 39(8): 822–8.

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