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**ESTETSKA KOMPONENTA INDEKSA POTREBE ZA ORTODONTSKOM TERAPIJOM KOD ADOLESCENATA U SRBIJI**

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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 of orthodontic treatment is poor dental aesthetics, as a consequence of occlusal abnormalities. The aim of this study is to determine the need for orthodontic treatment on the basis of aesthetic component of IOTN index (the index of orthodontic treatment need), to compare the degree of aesthetic component of IOTN and subjective perception of individuals about their dental aesthetics, and to compare the evaluation of the aesthetic component of IOTN subject in comparison with evaluation of the therapist. Methods. The study was conducted on a sample of 316 students, age 15-19 years old, who were not in orthodontic treatment prior to the survey. The research was done by the usage of the index of orthodontic treatment need (IOTN) which consists of dental and aesthetic components on the basis of which the need for therapy is determined. The aesthetic component of the index was noted by the therapist (specialist of orthodontics), as well as subject himself. Results. According to grades of subjects the need for orthodontic treatment is present with 0.38% of male subjects and 2.00% of female subjects. According to evaluations of the therapists, the need for orthodontic treatment is present in 7.52% of male subjects and 8.00% of female subjects. Observing all subjects, the need for orthodontic treatment is present in 0.63% of subjects, and according to the therapist the need for orthodontic treatment is present in 7.59% of subjects. The mentioned difference is statistically significant. Conclusion. Obtained results show that there is a significant difference about the 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:

index of orthodontic treatment need (IOTN), malocclusion, aesthetics.
Apstrakt

Uvod / Cilj. Najveći motivacioni faktor za preduzimanje ortodontske terapije je loša dentalna estetika, kao posledica okluzalne nepravilnosti. Cilj ovog rada je da odredi potrebu za ortodontskom terapijom na osnovu estetske komponente IOTN indeksa (indeks potrebe za ortodontskom terapijom), da upoređi stepen estetske komponente IOTN-a i subjektivne percepcije ispitanika o njegovoj dentalnoj estetici, te da upoređi evaluaciju estetske komponente IOTN ispitanika u odnosu na terapeuta. Metode. Istraživanje je sprovedeno na uzorku od 316 učenika, uzrasta 15-19 godina koji prije istraživanja nisu bili u ortodontskoj terapiji. Na osnovu IOTN indeksa izvršena je procena potrebe za ortodontskom terapijom. Indeks potrebe za ortodontskom terapijom (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 prisutna je kod 0.38% ispitanika muškog pola, te 2.00% ispitanika ženskog pola. Prema ocenama terapeuta, potreba za ortodontskom terapijom prisutna je kod 7.52% ispitanika muškog pola, te 8.00% ispitanika ženskog pola. Posmatrajući sve ispitanike, potreba za ortodontskom terapijom prisutna je kod 0.63% ispitanika, a prema mišljenju terapeuta potreba za ortodontskom terapijom prisutna je kod 7.59 % ispitanika. Pomenuta razlika je statistički značajna. Zaključak. Dobijeni rezultati pokazuju da postoji značajna razlika u pogledu na estetiku zuba i potrebu za ortodonstkom terapijom između ispitanika i terapeuta. Ovo može biti razlog za zabrinutost, jer pacijenti koji nisu svesni svoje ortodontske nepravilnosti mogu ograničiti potrebu za daljim lečenjem.

Ključne reči: Indeks potrebe za ortodontskom terapijom IOTN, malokluzije, estetika.

Introduction
Malocclusion represent a variation regarding to 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 its self-image depends on many factors: religious, social, cultural and others. Some patients are not even aware of their irregularities, while others complain of a lot less irregularities [2,3,4]. 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 its 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 (its aesthetic component).

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

Dental component of the index includes various occlusal traits which are divided into five categories (degrees), depending on the severity. The first and second degree - no need or slight need for orthodontic treatment, the third degree – borderline need for the therapy and the fourth and fifth degree indicate a great need for orthodontic treatment [2,3,6,7,8,9]. While determining this component of the index, every alteration is not marked, but the worst occlusal trait is determined, the one which defines the highest degree of the need for therapy [1].

The aesthetic component of the index consists of ten intraoral photographs depicting various malocclusion graded according to aesthetic appeal: from the most attractive to the most unattractive dental look [2,3,6,7]. By using of this component of the index it can be assessed how much is the facial appearance disturbed with 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 the aesthetic component of the index are that it is subjective and that it does not measure occlusal traits. The aesthetic component of IOTN
assesses the aesthetic aspects of the malocclusion, only in frontal view and emphasizes the subjective nature of it [12].

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

In many countries, researches on the use of IOTN index are conducted, for example, in Saudi Arabia (Hasan, 2006 and Albarakati, 2007) [14, 15], Nigeria (Kolawole and associates, 2008, Aikinisand associates, 2012) [16, 17], France (Souames and associates, 2006) [18], Italy (Nobile and associates, 2007) [19], Iran (Hedayat and associates, 2007) [20], Spain (Manzanera and associates, 2009) [21] and Serbia (Janošević and associates, 2015) [22].

The aim of this study is to determine the need for orthodontic treatment on the basis of aesthetic component of IOTN index, to compare the degree of aesthetic component of IOTN and subjective perception of individuals about their dental aesthetics, and to compare the evaluation of the aesthetic component of IOTN subject in comparison with evaluation of the therapist.

**Methods**

In this study, 316 students (226 boys and 50 girls) of military gymnasium in Belgrade were examined. Students were aged 15-19 years and up to the moment of the research they weren’t subjected to orthodontic treatment. Male and female army students participated in the study on a voluntary basis with informed consent. Students were examined as part of the oral health project of the military medical academy. Clinical examination was performed by one dentist, specialist in orthodontics, in dental clinic of the military barracks. During the examination of students, the aesthetic component of the index was noted by the therapist as well as by each student.

The aesthetic component of the index consists of ten intraoral photos that are graded according to the aesthetic appeal of the teeth. The first photo represents the most attractive and tenth the least attractive degree. Aesthetic scale is divided into three categories, according to the need for treatment:
The first - no need for therapy (photos 1,2,3,4)
The second - borderline required therapy (photos 5,6,7)
The third - great need for therapy (photos 8,9,10)

For clinical determination of the index color photographs were used. The attractiveness of the teeth is rated according to the aesthetic scale, and the grade is the number that stands next to the photo. Students showed an aesthetic scale of 10 photographs and then selected a photograph that is most similar to their tooth appearance.

Figure 1. Aesthetic component of the IOTN index
During the examination the appearance of the student's teeth was compared with the photos and was 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 have previously undergone orthodontic therapy have not been included in the study. Patient who have not given their consent or are undergoing orthodontic therapy are also not included in the study.

Statistical analysis

For statistical analysis of the data software IBM SPSS Statistics 21.0 for Windows was used. As statistically significant the values in which p <0.05 were taken. Data were evaluated by using X square test, Mann - Whitney test, Kolmogorov - Smirnov test and Spearman correlation.

Results

The need for orthodontic treatment based on AC of IOTN of subjects is shown in Table 1. According to the AC components of IOTN 95.25 % of the subjects did not have the 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). There were no statistically significant differences between the sexes during the AC grading within IOTN.

Table 1. The frequency and percentage distribution of subjects by gender and the need for orthodontic treatment (assessment of subjects)

<table>
<thead>
<tr>
<th>Need for orthodontic treatment based on subjects</th>
<th>Gender</th>
<th></th>
<th></th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Male</td>
<td>Female</td>
<td>Total</td>
<td></td>
</tr>
<tr>
<td>No need for therapy</td>
<td>254</td>
<td>47</td>
<td>301</td>
<td>95.25</td>
</tr>
<tr>
<td>Borderline need therapy</td>
<td>11</td>
<td>2</td>
<td>13</td>
<td>4.11</td>
</tr>
</tbody>
</table>
The need for orthodontic treatment based on AC of IOTN by the therapist is shown in Table 2. According to the AC component of IOTN of the therapist 83.23% of the 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).

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

Table 2. The frequency and percentage distribution of subjects by gender and the need for orthodontic treatment (assessment of therapist)

<table>
<thead>
<tr>
<th>Need for orthodontic treatment</th>
<th>Gender</th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Male</td>
<td>%</td>
<td>Female</td>
<td>%</td>
<td>Total</td>
</tr>
<tr>
<td>No need for therapy</td>
<td>224</td>
<td>84.21</td>
<td>39</td>
<td>78.00</td>
<td>263</td>
</tr>
<tr>
<td>Borderline need for therapy</td>
<td>22</td>
<td>8.27</td>
<td>7</td>
<td>14.00</td>
<td>29</td>
</tr>
<tr>
<td>Great need for therapy</td>
<td>20</td>
<td>7.52</td>
<td>4</td>
<td>8.00</td>
<td>24</td>
</tr>
<tr>
<td>Total</td>
<td>266</td>
<td>100.00</td>
<td>50</td>
<td>100.00</td>
<td>316</td>
</tr>
</tbody>
</table>

χ²  Df  P
1.713  2  0.425

If we consider all subjects, grades of subjects and therapist were in statistically significant medium strong positive correlation (Table 3).

Table 3. Spearman correlation score of subjects and therapists (all subjects)
The correlation score of subjects with a score of therapists in all subjects

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

By observing all subjects, orthodontic treatment according to the subjects need 0.63% of subjects, according to the therapist need 7.59% of subjects. There were statistically significant difference (table 4).

Table 4. The frequency and percentage distribution of all subjects by the need for orthodontic treatment (assessment of subjects and therapist)

<table>
<thead>
<tr>
<th>Need for orthodontic treatment</th>
<th>Subjects</th>
<th>Therapist</th>
</tr>
</thead>
<tbody>
<tr>
<td>(all subjects and therapist)</td>
<td>N</td>
<td>n</td>
</tr>
<tr>
<td>No need for therapy</td>
<td>301</td>
<td>263</td>
</tr>
<tr>
<td>Borderline need for therapy</td>
<td>13</td>
<td>29</td>
</tr>
<tr>
<td>Great need for therapy</td>
<td>2</td>
<td>24</td>
</tr>
<tr>
<td>Total</td>
<td>316</td>
<td>316</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>χ²</th>
<th>Df</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>27.271</td>
<td>2</td>
<td>&lt;0.001</td>
</tr>
</tbody>
</table>

If we consider only male subjects, grades of participants and of the therapist were in statistically significant medium strong positive correlation (Table 5).

Table 5. Spearman correlation score of subjects and therapists (male subjects)
The correlation score of subjects with a score of therapists in male subjects is 0.452, <0.001, 266.

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, orthodontic treatment need 0.38% of subjects, according to the therapists orthodontic treatment need 7.52% of subjects. There were statistically significant difference (Table 6).

Table 6. The frequency and percentage distribution of male subjects by the need for orthodontic treatment (assessment of subjects and therapist)

<table>
<thead>
<tr>
<th>Need for orthodontic treatment (male subjects)</th>
<th>Subjects</th>
<th>Therapist</th>
</tr>
</thead>
<tbody>
<tr>
<td>No need for therapy</td>
<td>254</td>
<td>224</td>
</tr>
<tr>
<td>Borderline need for therapy</td>
<td>11</td>
<td>22</td>
</tr>
<tr>
<td>Great need for therapy</td>
<td>1</td>
<td>20</td>
</tr>
<tr>
<td>Total</td>
<td>266</td>
<td>266</td>
</tr>
<tr>
<td>( \chi^2 )</td>
<td>22.740</td>
<td>&lt;0.001</td>
</tr>
</tbody>
</table>

If we look at the female subjects, grades of the participants and of the therapist are in statistically significant correlation (Table 7).

Table 7. Spearman correlation score of subjects and therapists (female subjects)

<table>
<thead>
<tr>
<th>R</th>
<th>P</th>
<th>N</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.530</td>
<td>&lt;0.001</td>
<td>50</td>
</tr>
</tbody>
</table>

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, orthodontic treatment need 2.00% of subjects, according to the therapists orthodontic treatment need 8.00% of subjects. There were statistically significant difference (Table 8).

Table 8. The frequency and percentage distribution of female subjects by the need for orthodontic treatment (assessment of subjects and therapist)

<table>
<thead>
<tr>
<th>Need for orthodontic treatment (female subjects)</th>
<th>Subjects</th>
<th>Therapist</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N</td>
<td>%</td>
</tr>
<tr>
<td>No need for therapy</td>
<td>47</td>
<td>94.00</td>
</tr>
<tr>
<td>Borderline need for therapy</td>
<td>2</td>
<td>4.00</td>
</tr>
<tr>
<td>Great need for therapy</td>
<td>1</td>
<td>2.00</td>
</tr>
<tr>
<td>Total</td>
<td>50</td>
<td>100.00</td>
</tr>
</tbody>
</table>

\[ \chi^2 \] Df P
5.322 2 0.070

Discussion

Demand for orthodontic treatment, in recent years, has increased in many countries, together with increased general awareness about aesthetics. In our country the same right for orthodontic treatment have the children with small aesthetic imperfections and the children with serious occlusal anomalies. Introduction of indices 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].

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

According to this survey, for 8% of subjects there is a great need for orthodontic treatment based on the analysis of aesthetic components of IOTN index with a significant difference in the assessments of subjects and therapists. Similar to our results Janošević and associates (2015), [22] found out that for 15.3% of subjects had malocclusions that needed treatment from an aesthetic viewpoint.

Similar assessments, based on the analysis of aesthetic components of IOTN index, gave Souames (2006), [18] as part of his research among children aged 9 to 12 years in France. Thus, according to him, 7% of children have great need for orthodontic treatment. Here were no significant differences in the aesthetic evaluation between boys and girls.

Our study showed a significant difference between the grade of the subjects and the therapist, which is the case with Nobile in Italy (2007), [19].

Nobile conducted a study among children aged 11 to 14 years in which he compared aesthetic components of the index grades between the examiner and the examined children. So he came to the following results: therapists have found that therapy was necessary in 8.6% and subjects in 3.2% of subjects. Based on these results, he came to the conclusion that the expert opinion of the therapists is significantly more critical than the views of subjects in relation to the disruption of the face aesthetic with present orthodontic abnormalities.

As well as Nobile, Manzanera (2009), [21] and Hedayati (2007), [20] found the less need for orthodontic treatment based on analysis of aesthetic component of the IOTN index.

Contrary to our study, a study in Shiraz found the 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 on the bases of aesthetic component of IOTN index that 4.11% of the students have a great need for orthodontic treatment. Therapists also gave similar ratings, therapy was necessary for 6.21% of the students. Their results show that the need for orthodontic treatment is less, 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 the treatment planning. Assessment of the patient about the need of orthodontic treatment is not always in correlation with professional assessment. This was determined by Hassan (2006), [14], Kolawole (2008), [16], Aikinis (2012) [17], Hamdan (2004) [25] and Ousehal (2011) [26].

Aikinis noticed a significant difference between patient and therapists in ranking of the attractiveness of occlusion, during research on subjects ranging from 12 to 18 years old on the territory of Nigeria. Based on the perception of the therapist 17.6% of subjects have great need for therapy. In patient’s perception 6.5% of subjects have a great need for therapy. Age and gender didn’t have no impact on the assessment of the need for orthodontic therapy [17].

Also, Soh and Sandham found no correlation between the subjects and the therapists. They studied Asian male army recruits age 17-22 years, subjects perceived dental aesthetics differently from that of the therapist which is similar to that of the present study [27]. As in our study men were generally more satisfied with their dental appearance and less likely to perceive a need for orthodontic treatment 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 aesthetic component of IOTN index of the therapist and subjects found by Albarakati and associates (2007), [15], Siddigui and associates (2014), [28] and Ghijselings with associates (2014), [29].

Siddigui and associates conducted a study on this index on children aged 16 to 25 and reached a significant positive relations between perceptions of the therapists and patients [28]. In comparison with children in the 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. Therapists in assessing the aesthetic component 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].

Cai and associates have established on the basis of the therapist’s assessment that the need for therapy is present in 32% of the subjects, and only 11% of the subjects think that orthodontic therapy is necessary [30]. In this study, as in our, the opinion of young people
about the aesthetic appearance of their teeth differs from the opinion of the therapists. They
don't 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 to explain why further therapy is needed. This improves
communication between the patient and therapist, better understanding and better results
are achieved in the treatment.

During this research, the influence of gender and personality traits on the subjective
perception of the aesthetic component was also assessed. Similar to our results, it was
concluded that young Chinese women are more critical about dental aesthetics than man,
and emotionally introvert people are more critical when their dental aesthetics is concerned
[30, 31].

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

The correct identification of patients in need of orthodontic treatment since early
ages of life allows interceptive treatments to prevent the increase in the severity of the
disorders and the need for more complex and expensive corrective orthodontic treatments
[32].

If the patient's understanding of the need for treatment or an aesthetic classification
is not the same as therapists 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]. Although for efficient
orthodontic treatment must take into consideration the perception of the patient, not just the
professional assessment of the therapist in order to ensure patient satisfaction. Good
correlation between self-perception and the real need for therapy indicates that patients are
able to understand their clinical condition.
Conclusion

The results obtained show that subjects don't have quite a rational view about the aesthetics of the teeth, they are not aware of the seriousness of orthodontic irregularities and the need for orthodontic treatment. Before the start of therapy, patients need to explain in detail the real need for orthodontic therapy. Better understanding of the patient has positive effect on the goals of the treatment, reduces the likelihood of compromised outcomes of the treatment and guarantees better results.

Using the IOTN index, it is possible to estimate the need for orthodontic therapy considering the dental and aesthetic component of orthodontic anomalies. Owing 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 treatment and to correctly allocate the resources of dental health care.

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Each student voluntarily took part in study and was informed about the process of data collection.

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