

Orthodontic treatment complexity, outcome and need among school age patients of Lithuanian university of health sciences clinic of orthodontics

Rokas Liausas*, Zygimantas Labanauskas*, Vilma Svalkauskiene*, Dalia Smailiene*, Justina Vaiciuniene**

SUMMARY

Aim of the work. It has not been any well-documented study describing the prevalence of orthodontic anomalies between school-age children seeking orthodontic treatment at LUHS (Lithuanian university of health sciences) clinic of Orthodontics. Our aim was to assess the prevalence of orthodontic problems and to determine orthodontic treatment need, complexity and outcome for school-age patients who were treated at LUHS clinic of Orthodontics.

Material and methods. Our study sample consists of 336 scholars 6-19 years old who were treated at LUHS clinic of orthodontics from 2013 to 2018. ICON index is used to determine the complexity, outcome and need of orthodontic treatment. Statistical analysis is performed using the statistical software package IBM SPSS Statistics 24.0. Quantitative variable distribution is assessed visually and by using the Shapiro-Wilk test.

Results. The estimated need for orthodontic treatment is 56.3 percent among patients. The need of treatment for 6-10 year old group is significantly higher than for 11-14 and 15-19 groups (69.0, 52.3 and 51.2 percent). In the group of 11-14 year olds the need of treatment between boys and girls differs significantly (63.1 percent in boy group, 43.8 percent in girl group). Moreover in the 11-14 year old group, the complexity of treatment "easy" is more frequent than in the 6-10 group.

Conclusions. The need of orthodontic treatment is 56.3 percent among subjects treated in LUHS clinic of orthodontics from 2013 to 2018. In all age groups the complexity of treatment is mostly "easy" or "mild".

Key words: orthodontics, ICON index, treatment need, malocclusion.

INTRODUCTION

There are numerous studies conducted describing the prevalence of orthodontic anomalies. Some articles show that among their study sample there are as low as 29.2 percent subjects with orthodontic anomalies (1), in other researches it even reaches 93 percent (2, 3). It is because orthodontic anomalies vary between races, genders and countries. According to Merritt et al, orthodontic anomalies are the most common among afroamerican people and the least prevalent among caucasian race (4). Evaluat-

ing prevalence between genders Bellot-Arcis et al, states that two thirds of their treated patients are women, but they explain that men are not so concerned about their looks and occlusion (5). Based on Hyun-Woo Lim's analysis, there is a tendency to see an increasing need for orthodontic treatment in both developing and developed countries, because of the increasing economy (6). Keeping all the factors in mind it is interesting to understand the situation in Lithuania.

Orthodontic anomalies are associated with quality of life. Henson et al, states that people without orthodontic anomalies have 10 percent better chance of finding a job and developing new social connections (7). Moreover, nowadays people seek orthodontic treatment more for aesthetic reasons than the functional ones (8). So it is also necessary

*Clinic of Orthodontics. Faculty of Odontology. Lithuanian University of Health Sciences. Kaunas. Lithuania

**Private practice

Address correspondence to Vilma Svalkauskiene. Clinic of Orthodontics. Faculty of Odontology. Lithuanian University of Health Sciences. J. Lukšos-Daumanto g. 6. LT-3009 Kaunas. Lithuania.

E-mail address: vilma.svalkauskiene@gmail.com

to analyze aesthetic component during evaluation of the prevalence of orthodontic anomalies.

Currently several indexes, such as DAI (dental aesthetic index), ICON (index of complexity, outcome and need), IOTN (index of orthodontic treatment need), are used to identify occlusion's morphological and aesthetic deficiencies and to plan treatment. ICON is one of the most commonly used index and is evaluated for its accuracy in many studies. In 2008, Yijin Ren and co-authors examined subjective patients' opinions and objective doctors' opinions on the need for treatment. The findings of the study show that patients' subjective opinion about their dental condition is directly correlated with the numerical values of the ICON index (9), Yltze P. Cubas and colleagues in 2012 compared the reliability of the use of IOTN and ICON indices among dental students. The results showed that the ICON index is more accurate than the IOTN (10), The ICON index was chosen for our study, as we consider this index to be one of the most reliable and simple indices for determining the necessity and complexity of orthodontic treatment.

Last well-assessed data of prevalence of orthodontic anomalies between schoolchildren was presented in doctoral thesis by dr. D. Baubiniene in 2010 (11). Unfortunately, it has been almost 10 years since this data has been published. Also authors evaluated children randomly selected from schools, while our study focuses on scholars seeking orthodontic treatment. The aim of this study is to determine the necessity and complexity of orthodontic

Table 1. Age and gender distribution of our study sample (n=336)

	6-10 years old	11-14 years old	15-19 years old
Boys	34	76	41
Girls	50	96	39

Table 2. IOTN aesth, comp, and ICON values between boys of different age groups. Mean±SD (Standard deviation)

Index	Boys (n=151)			P
	6-10 years old	11-14 years old	15-19 years old	
IOTN aesth, comp.	4.26±2.46	4.25±2.05	3.51±1.55	0.141
ICON	54.26±26.28	52.57±21.09	46.49±16.49	0.224

Statistically significant if p<0.05.

Table 3. IOTN aesth, comp, and ICON values between girls of different age groups. Mean±SD (Standard deviation)

Index	Girls (n=185)			P
	6-10 years old	11-14 years old	15-19 years old	
IOTN aesth, comp.	4.16±1.82	3.40±1.88	3.56±1.90	0.065
ICON	53.64±16.80	43.98±18.84	45.64±18.84	0.010*

* – statistically significant difference between 6-10 and 11-14 years old groups (p<0.05).

anomalies among school-age (6-19 years) patients who were treated at LUHS orthodontic clinic during the period of 2013-2018.

MATERIAL AND METHODS.

The study was conducted at LUHS orthodontic clinic from June 2017 to January 2018. Permission for the study was acquired from LUHS centre of bioethics no. BEC-OF-80. Allowance to collect data from LUHS archives for the period from 2013 till 2018 was also approved no. TPP-2194.

The subjects are children who were treated at the LUHS orthodontic clinic from 2013 to 2018. We grouped them according to the age: 6-10, 11-14 and 15-19 years old. LUHS orthodontic clinic has about 2.500 new school aged patients every year, so it is estimated that at least 322 subjects are required to have statistically reliable data. The total number of subjects included in the study is 336. The subjects had to meet the following criteria: 6-19 years old, no history of dental trauma, no craniofacial abnormalities or syndromes, good quality initial diagnostic material: plaster models and photographs.

Plaster models, intraoral and extraoral photographs done before the orthodontic treatment were collected. All measurements were carried out using ruler and calliper by the first author R.L. ICON index, IOTN aesthetic component (aesth. comp.), individually and added to the overall score for the ICON index calculation, and occlusion type (deciduous, mixed, permanent) were evaluated and counted. ICON index consists of 5 components: aesthetic component (IOTN aesthetic component), 4 dental components (maxillary and mandible crowding or spacing, anterior teeth open bite or deep bite, cross bite, if present or not and sagittal relationship of posterior teeth). Each component is multiplied by the coefficient describing severity of the malocclusion and then added up (12). We used ICON value of 43 as the threshold for the need of orthodontic treatment.

4 weeks after data collection, reliability of measurements was evaluated, 36 subjects' models and photographs were recollected and remeasured. The principle of consistency was respected, i.e. patient models and pho-

tographs were examined sequentially as in the main study. The kappa coefficient was counted (13, 14).

Statistical data analysis was performed using the statistical software package IBM SPSS Statistics 24.0. The distribution of the quantitative variable was evaluated visually and using the Shapiro-Wilk test. Non-parametric analysis ANOVA was used to explain the differences between the mean values of the IOTN aesthetic component and the ICON index in the three age groups. Mann-Whitney U test was used to evaluate the reliability of the difference between the values of the two groups. The significance level of $p < 0.05$ was used to verify the statistical hypotheses.

RESULTS

After re-evaluation of data, kappa coefficient was calculated. The resulting value is (0.78), which means that the reliability of the data is good and substantial.

The study consists of 336 subjects: 151 (44.9%) boys and 185 (55.1%) girls. The average age of the subjects is 12.46 ± 2.92 years (boys 12.72 ± 2.95 , girls 12.25 ± 2.88). In further analysis, the subjects are divided by gender and age into three groups. The largest number of subjects (51.2%) consists of 11-14 year olds, 6-10 years old group represents 25% of study sample and 15-19 years old group – 23.8%. Age and gender distribution is presented in Table 1.

In both 6-10 and 11-14 years old age groups mixed dentition is the most prevalent – 70 subjects (83.3%) and 163 (94.8%) respectively. In the 15-19 years old age group subjects have only permanent dentition – 80 (100%).

Comparing IOTN aesthetic component and ICON index between boys of different ages there are no statistically significant differences between any groups (Table 2). On the other hand by testing differences between girls of different age groups, we found that 6-10 year old girls have significantly higher ICON values than those in 11-14 years old group (Table 3).

Comparing results between boys and girls of different age groups we found that boys of 11-14 have statistically significant higher ICON and IOTN (aesth. comp.) values than girls of the same age ($p < 0.05$). Other age groups don't show statistically significant differences.

After evaluation of ICON values the need for orthodontic treatment is 56.3% among our study sample. Differences between age groups of all subjects are presented in Table 4.

Distributing data by the complexity of orthodontic treatment by ICON values, we found that in all age groups most of the subjects are considered as mild treatment group (Table 5).

DISCUSSION

The results of this study reflect patients randomly selected and tested at the LUHS orthodontic clinic, who have been treated in the period of 2013-2018. The latest large-scale study on this topic was performed by Baubiniene et al in 2010 (11). The results of the study show that the need for orthodontic treatment is 42.6 percent between school children. The complexity of treatment in the 10-11 year old group is "very severe" for 6.7% subjects and in the 14-15 age group – 4.1%. Our study concluded that 56.3% of subjects need orthodontic treatment.

Table 4. Amount of subjects of each group who need orthodontic treatment (ICON value > 43)

Treatment need	Age groups			p
	6-10 years old	11-14 years old	15-19 years old	
All	58 (69.0%)	90 (52.3%)	41 (51.2%)	0.024**
Boys	21 (61.8%)	48 (63.1%)	22 (53.6%)	0.593
Girls	37 (74.0%)	42 (43.8%)	19 (48.7%)	0.002***
p	0.234	0.01*	0.659	

* – statistically significant difference between boys and girls group ($p < 0.05$).

** – statistically significant difference between all age groups ($p < 0.05$).

*** – statistically significant difference between all age groups of girls ($p < 0.05$).

Table 5. Amount of subjects of each group according to their treatment complexity (12)

Treatment complexity	Age groups			p
	6-10 years old	11-14 years old	15-19 years old	
Easy ICON value < 29	9 (10.7%)	36 (20.9%)	9 (11.3%)	0.046*
Mild ICON value 29-50	35 (41.7%)	74 (43.0%)	46 (57.5%)	0.064
Moderate ICON value 51-63	13 (15.5%)	26 (15.1%)	14 (17.5%)	0.886
Difficult ICON value 64-77	15 (17.9%)	21 (12.2%)	7 (8.8%)	0.207
Very difficult ICON value > 78	12 (14.3%)	15 (8.7%)	4 (5.0%)	0.115

* – statistically significant difference between 6-10 and 11-14 years old groups ($p < 0.05$).

The complexity of treatment is considered as "very severe" in the group of 6-10 year olds for 14.3% patients, in the group of 11-14 – 8.7%. Our results suggest that there is an increase in orthodontic treatment need, but reason for that could be the methodological difference. Our study population was acquired from patients who were seeking treatment at LUHS orthodontic clinic, while Baubiniene et al, evaluated random children from public schools. More researches done in Lithuania on this topic that could be compared has not been found.

When considering the overall need for orthodontic treatment the threshold values are very important. ICON index creators recommend that the need for orthodontic treatment should be considered necessary when the index value is above 43, or when there is a significant aesthetic defect. However, in a study conducted in Iran authors recommend that the numerical value of the index should be reduced to 35 (15), while Dutch authors recommend to increase it to 52 (16). We consider the need for orthodontic treatment when the value is above 43, because we do not have any special recommendations or previous studies showing the need for different index value in Lithuanian population.

Comparing our results with similar studies from other countries, the prevalence in Lithuania could be considered as moderate according to worldwide data; unfortunately, in most other European countries the need is considered lower. A study conducted in 2015 in Turkey found that the need for orthodontic treat-

ment in the 12-16 years old age group is 28% (17). In Sweden, in 2007, for young people under the age of 18 the need for orthodontic treatment was 37 percent (18). In UK in 2003, it was found that the need for treatment for young patients is 33.5% (19). French authors concluded that the need for students in their study is 21.3 percent (20). In Italy – 27.3% (21). In Brazil in 2013, even 65.5 percent of the total number of subjects needed orthodontic treatment. 70 percent of Saudi Arabia school age children need orthodontic treatment (22). In a study conducted in Morocco in 2012, even 84.2 percent of the 8-12 year old children need orthodontic treatment (23).

CONCLUSIONS

1. Every second school aged person need orthodontic treatment according to the ICON values, 6-10 years old children show higher need of orthodontic treatment. Boys of 11-14 years old group represent higher need for orthodontic treatment than girls of the same age.

2. In the 11-14 years old age group, the complexity of treatment is considered as "easy" more often than in the 6-10 year old group. Most of the patients are considered as "easy" or "mild" orthodontic treatment subjects.

STATEMENT OF CONFLICTS OF INTEREST

The author denies a conflict of interest.

REFERENCES

- Guaba K, Ashima G, Tewari A, Utreja A. Prevalence of malocclusion and abnormal oral habits in North Indian rural children. *J Indian Soc Pedod Prev Dent* 1998;16:26-30.
- Ciuffolo F, Manzoli L, D'Attilio M, Tecco S, Muratore F, Festa F, et al. Prevalence and distribution by gender of occlusal characteristics in a sample of Italian secondary school students: a cross-sectional study. *Eur J Orthod* 2005;27:601-6.
- Keski-Nisula K, Lehto R, Lusa V, Keski-Nisula L, Varrela J. Occurrence of malocclusion and need of orthodontic treatment in early mixed dentition. *Am J Orthod Dentofacial Orthop* 2003;124:631-8.
- Mossey P. The Heritability of malocclusion: Part 2. The influence of genetics in malocclusion. *Br J Orthod* 1999;26:195-203.
- Merritt JM., Greenlee G, Bollen AM., Scott JM, Chi DL. Racial disparities in orthodontic service utilization for medicaid-enrolled children: an evaluation of the washington medicaid program. *Am J Orthod Dentofacial Orthop* 2016;149:516-22.
- Bellot-Arcis C, Montiel-Company JM, Manzanera-Pastor D, Almerich-Silva JM. Orthodontic treatment need in a Spanish young adult population. *Med Oral Patol Oral Cir Buccal* 2012; 17: e638–e43.
- Lim HW, Park JH, Park HH, Lee SJ. Time series analysis of patients seeking orthodontic treatment at Seoul National University Dental Hospital over the past decade. *Korean J Orthod* 2017;47:298-305.
- Henson ST, Lindauer SJ, Gardner WG, Shroff B, Tufek E, Best AM. Influence of dental esthetics on social perceptions of adolescents judged by peers. *Am J Orthod Dentofacial Orthop* 2011;140:389-95.
- de Almeida AB, Leite IC. Orthodontic treatment need for Brazilian schoolchildren: a study using the Dental Aesthetic Index. *Dent Press J Orthod* 2013;18:103-9.
- Ren Y, Boxum C, Sandham A. Patients' perceptions, treatment need, and complexity of orthodontic re-treatment. *Eur J Orthod* 2009;31:189-95.
- Cubas YP, Hardy T, Dhillon DK, Orellana MF. Effectiveness of training dental students in two occlusal indices. *J Dent Educ* 2012;76:739-45.
- Baubiniene D. Ortodontinių anomalijų paplitimas ir gydymo reikalingumas tarp Lietuvos moksleivių [disertacija]. Kaunas: Lietuvos sveikatos mokslų universitetas; 2010.
- Daniels C, Richmond S. The Development of the index of complexity, outcome and need (ICON). *Br J Orthod* 2000;27:149-62.

14. Cohen J. A Coefficient of agreement for nominal scales. *Educ Psychol Meas* 1960;20:37-46.
15. McHugh ML. Interrater reliability: the kappa statistic. *Bioch Med* 2012; 22:276-82.
16. 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;16:149-55.
17. Lowerse TJ, Aartman IHA, Kramer GJC, Prah-Andersen B. The reliability and validity of the index of complexity, outcome and need for determining treatment need in Dutch orthodontic practice. *Eur J Orthod* 2006;28:58-64.
18. Bilgic F, Gelgor IE, Celebi AA. Malocclusion prevalence and orthodontic treatment need in central Anatolian adolescents compared to European and other nations' adolescents. *Dent Press J Orthod* 2015; 20:75-81.
19. Josefsson E, Bjreklin K, Lindsten R. Malocclusion frequency in Swedish and immigrant adolescents - influence of origin on orthodontic treatment need. *Eur J Orthod* 2007;29:79-87.
20. Chestnutt IG, Burden DJ, Steele JG, Pitts NB, Nuttall NM, Morris AJ. The Orthodontic condition of children in the United Kingdom. *Br Dent J* 2006;200:609-12.
21. 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;28:605-9.
22. Perillo L, Masucci C, Ferro F, Apicella D, Baccetti T. Prevalence of orthodontic treatment need in southern Italian schoolchildren. *Eur J Orthod* 2010;32:49-53.
23. Al-Jobair AM, Baidas LF, Al-Hamid AA, Al-Qahtani S, Al-Najjar AT, Al-Kawari HM. Orthodontic treatment need among young Saudis attending public versus private dental practices in Riyadh. *Clin Cosmet Investig Dent* 2016;8:121-29.
24. Bourzgui F, Sebbar M, Hamza M, Lazrak L, Abidine Z, El Quars F. Prevalence of malocclusions and orthodontic treatment need in 8- to 12-year-old schoolchildren in Casablanca, Morocco. *Prog Orthod* 2012;13:164-72.

Received: 18 03 2018
Accepted for publishing: 20 03 2019