# Predictors of patient compliance during Class II division 1 malocclusion functional orthodontic treatment

**Stefanović, Neda; Uhač, Mia; Brumini, Martina; Žigante, Martina; Perković, Vjera; Špalj, Stjepan**

*Source / Izvornik:* **Angle orthodontist, 2021, 3, 502 - 508**

**Journal article, Published version**
**Rad u časopisu, Objavljena verzija rada (izdavačev PDF)**

https://doi.org/10.2319/090820-780.1

*Permanent link / Trajna poveznica:* https://urn.nsk.hr/urn:nbn:hr:271:951768

*Original Article*

# Predictors of patient compliance during Class II division 1 malocclusion functional orthodontic treatment

**Neda Lj Stefanovic[a]; Mia Uhac[b]; Martina Brumini[c]; Martina Zigante[d]; Vjera Perkovic[d]; Stjepan Spalj[e]**


## ABSTRACT

**Objectives:** To determine factors that could predict Class II/1 malocclusion patient compliance during functional treatment.

**Materials and Methods:** The sample consisted of 77 subjects (aged 11–13 years; 47% girls) presenting with Class II/1 malocclusion. Inclusion criteria were distal molar relationship, overjet greater than 5 mm, and confirmed pubertal growth spurt. Removable functional appliances (62% Twin Block [TB], 38% Sander Bite Jumping [BJ]) with built-in maxillary expansion screws were used. Follow-up period was 1 year. Patients and parents independently filled out the Child Perception Questionnaire, Parental/Caregiver Perception Questionnaire, and Family Impact Scale to assess emotional and social well-being, oral symptoms, functional limitations, parental emotions, family activities, conflicts, and financial burden as possible predictors of compliance during treatment. Sex, overjet, and appliance type were also analyzed.

**Results:** There were more noncompliant than compliant patients (55% vs 45%). Parental perception of altered emotional well-being of their children was the strongest predictor, increasing compliance odds 3.4 times (95% confidence interval [CI], 1.2–9.4; $P = .017$). Patients were 3.2 times (95% CI, 1.1–9.3; $P = .033$) more likely to cooperate with TB compared with BJ appliance. OJ $\geq$ 8 mm increased compliance odds 3.1 times (95% CI, 1.0–9.4; $P = .044$).

**Conclusions:** Parental perception of child's emotional well-being alteration, severity of malocclusion, and type of appliance are major predictors of compliance. Psychosocial issues and oral function limitations reported by children and family impact are of negligible influence. (*Angle Orthod.* 2021;91:502–508.)


**KEY WORDS:** Predictors; Class II/1; Functional treatment; Adolescents; Preadolescents

## INTRODUCTION

Class II is an anteroposterior skeletal discrepancy caused by various combinations of skeletal and dental components. It can be caused by mandibular retrognathism, maxillary prognathism, or a combination of the two. Although one group of authors claimed it was most commonly a consequence of mandibular retrognathism,[1] others disagreed.[2] Different vertical facial patterns have been reported in Class II subjects. According to the upper incisor inclination, Class II is divided into Class II division 1 (Class II/1) when the incisors are proclined and Class II division 2 (Class II/2) when the incisors are retroclined.[1,3,4]

[a] Assistant Professor, Department of Orthodontics, Faculty of Dental Medicine, University of Belgrade, Belgrade, Serbia.
[b] Resident, Department of Orthodontics, University Dental Clinic, Clinical Hospital Center, Rijeka, Croatia.
[c] Dentist, Community Health Center of Primorsko-Goranska County, Rijeka, Croatia.
[d] Research Fellow, Department of Orthodontics, University Dental Clinic, Clinical Hospital Center. Research Fellow, Department of Orthodontics, Faculty of Dental Medicine, University of Rijeka, Rijeka, Croatia.
[e] Professor, Department of Orthodontics, University Dental Clinic, Clinical Hospital Center, Rijeka, Croatia. Professor, Department of Orthodontics, Faculty of Dental Medicine, University of Rijeka, Rijeka, Croatia. Professor, Department of Dental Medicine, Faculty of Dental Medicine and Health, J. J. Strossmayer University of Osijek, Osijek, Croatia.
Corresponding author: Dr Neda Lj Stefanovic, Zorza Klemansoa 18a, 11000 Belgrade, Serbia (e-mail: neda712@yahoo.com)

Accepted: December 2020. Submitted: September 2020.
Published Online: February 15, 2021


 **DOI:** 10.2319/090820-780.1

In growing children, Class II/1 is commonly treated using functional orthodontic appliances. Functional orthodontic treatment affects mandibular position and function by moving the mandible forward in relation to the normal rest position, therefore changing the muscle conditions and improving Class II discrepancy.[5–7] Some of the most commonly used removable functional orthodontic appliances are the Twin Block (TB) appliance and the Sander bite jumping (BJ) appliance. The TB appliance consists of upper and lower plates with posterior bite blocks with inclined planes that slide against each other and bring the mandible downward and forward when the mouth is closed. With the TB appliance in the mouth, the patient cannot occlude in the original locked distal position, thus the mandible is freed, and the unfavorable distal tooth contacts are replaced with favorable proprioceptive contacts of the TB inclined planes that bring the mandible to a protrusive position. Occlusal forces that are transmitted through the dentition deliver a continuous proprioceptive stimulus that influences the growth rate and the supporting bone trabecular structure.[8] Instead of posterior bite blocks, the Sander BJ appliance has two prongs embedded in the upper plate that meet the acrylic inclined plane in the anterior segment of the lower appliance when the mouth is closed and bring the mandible forward. The action mechanism of the BJ appliance is different during sleep and during the day. Not more than 600 biting actions have been recorded with the BJ appliance in place during the night. However, viscoelastic forces of 3 N have been measured during the night, and it is these forces that position the mandible forward and have the opposite effect on the maxilla. During the day, neuromuscular habituation of the appliance can be noted, and the mandible is positioned even further forward when the patient is talking and trying to avoid contact with the bars.[9–11]

Functional orthodontic treatment is most effective during the pubertal growth peak with more skeletal effects than in the prepubertal period.[12,13] Parental influence, impaired emotional well-being (EW), and the severity of malocclusion are the main factors prompting preadolescents and adolescents to demand orthodontic treatment, with parental influence being strong for preadolescents, but not for adolescents.[14] However, treatment success depends on many factors. One of the most essential aspects for orthodontic treatment success, especially when removable appliances are used, is patient compliance. Lack of cooperation may result in prolonged treatment time, suboptimal treatment results, and treatment cessation.[15,16] Different predictors of orthodontic treatment compliance and completion, such as quality-of-life measures, age, sex, type of appliance, socioeconomic status, severity of malocclusion, and treatment need have so far been investigated.[17] It has been shown that younger adolescents were more compliant than older adolescent patients and that cooperation gradually decreased throughout the removable orthodontic appliance treatment.[15] Good patient–doctor communication, encouragement, and positive reinforcement from the clinician and family members all improve removable appliance compliance. Reminders and mobile phone applications have a positive effect as well.[18] In addition, patients that pay for treatment seem to be more cooperative.[19] However, there are still not enough solid data to help improve patient compliance when using two-piece removable functional orthodontic appliances such as the TB appliance or the Sander BJ appliance.

The aim of this study was to determine factors that could predict compliance in patients with Class II/1 malocclusion during functional orthodontic treatment. The null hypothesis was that there would be no differences in compliance between the two types of appliances used. Alternative hypotheses were that impaired EW and social well-being (SW) of children in puberty would be the most important predictor of compliance, more so when reported by children rather than their parents, and that girls would be more compliant than boys.

## MATERIALS AND METHODS

The study sample was composed of 77 patients (41 boys, 36 girls) aged 11 to 13 years presenting with Class II/1 malocclusion. Inclusion criteria were distal molar occlusion, overjet (OJ) greater than 5 mm, and acceleration of pubertal mandibular growth assessed by the cervical vertebral maturation method[12] (stages CS3 or CS4). Of 82 eligible subjects who were invited to participate, 1 refused, 2 did not fill out all questionnaires, and 2 were excluded as a result of traumatic injury to the incisors after the start of treatment. All patients were treated with removable functional appliances (62% TB appliance, 38% Sander BJ) at the Department of Orthodontics, University Dental Clinic in Rijeka, Croatia, and treatment began between 2015 and 2018. Patients were assigned to the TB or BJ appliance groups using online randomization software (www.randomizer.org). The follow-up period for each patient was 1 year.

Both the TB and the BJ appliances had an expansion screw built into the maxillary plate. Labial bows were built into both the maxillary and the mandibular plates, and the acrylic behind the upper incisors was not ground during treatment. Wax bite registration was similar for both appliances (ie, 6 mm average anterior positioning of the mandible and 4 mm average vertical opening in the first molar area).

Patients were instructed to wear the appliance overnight and 4 hours during the day and to activate the maxillary expansion screw one-quarter turn per week during the first 6 months of treatment. OJ was measured at every bimonthly appointment. Patients with no OJ improvement that self-willingly discontinued treatment after the first appointment and those with no OJ improvement after 1 year of treatment (OJ reduction $\leq$ 2 mm with the OJ value $\geq$ 5 mm) were considered noncompliant.

Before the start of treatment, patients and their parents independently filled out the Child Perception Questionnaire (CPQ),[20] Parental/Caregiver Perception Questionnaire (PPQ),[21] and Family Impact Scale (FIS),[22] which were used to assess EW, SW, oral symptoms, functional limitations, parental emotions (PE), family activities, family conflicts, and financial burden as possible predictors of cooperation during orthodontic treatment. Oral symptoms were the presence of pain or sores in the mouth, bad breath, or food stuck between teeth; functional limitations were difficulties in chewing, pronunciation, or sleeping; EW included feeling shy, frustrated, upset, or concerned about teeth appearance; and SW referred to situations such as being teased, arguing with other children, or avoiding smiling or speaking in front of others. PE were assessed by situations such as being upset, uncomfortable in public places, or worried that the child would have fewer life opportunities; family activities included interrupting parental daily routines or parents having less time for other family members because the child required more attention or needing to take time off from work; family conflicts included the child being jealous, arguing, or causing disagreements; and financial burden was assessed by the question, "Has your child's condition caused financial difficulties for your family?"

OJ value, type of appliance, and sex were also analyzed. Two versions of the CPQ were used: the 16-item Regression Short Form (RSF-16) and the Item-impact Short Form (ISF-16) as well as the summary measure of the 8-item quality-of-life impairment (CPQ-8) in both forms (RSF and ISF). Children also reported their self-assessed oral health on a 5-point scale (0 for "excellent," 4 for "bad") and satisfaction with teeth appearance (0 for "not at all," 4 for "a lot").

The University of Rijeka Ethics Committee approved the study (No. 2170-24-01-15-2), and written informed consent was signed by each participant's parents. The study was performed according to the 1964 Declaration of Helsinki and its later amendments.

### Statistical Analysis

Differences between cooperative and noncooperative children were analyzed using the Mann-Whitney and Fisher exact tests. The effect size was calculated using Cramer V for the Fisher test and the formula $r = Z/\sqrt{N}$ for the Mann-Whitney test. Values 0.1 to 0.3 were interpreted as small, 0.3 to 0.5 as medium, and greater than 0.5 was a large effect size. Multiple logistic regression was applied to analyze the predictors of compliance with calculated odds ratios (ORs) and 95% confidence intervals (CIs). For logistic regression, the CPQ, PPQ, and FIS variables were dichotomized with cut-off values ranging from $\geq$1 to $\geq$4 for dimensions of children and parent perception of alteration of the quality of life and family impact. The commercial software SPSS version 22.0 (IBM Corp., Armonk, N.Y.) was used.

## RESULTS

The sample descriptive statistics are presented in Table 1.

During the 1 year of treatment and observation, there were more noncompliant than compliant patients (55% vs 45%). Of the noncompliant patients, 17% self-willingly discontinued treatment, whereas 83% kept the appointments, but no significant OJ value reduction was recorded.

Compliant patients had greater initial OJ values compared with the noncompliant patients and had greater self-reported oral health disturbance with a small effect size ($P = .014$, $r = 0.279$ and $P = .021$; $r = 0.263$; Figure 1). Greater dispersal of reported quality-of-life dimensions (child perspective and parent perspective) as well as family relations impact was observed (Figures 2 and 3). Other items reported by children did not show significant differences. However, it was noted that compliant patients were less pleased with their smile esthetics, had more functional limitations (child perception of functional limitations regression short form (FLr:C) and item-impact short form (FLi:C)), disturbed emotional and SW (child perception of EW [EW:C], child perception of social well-being regression short form [SWr:C] and item-impact short form [SWi:C]), and more overall quality-of-life impairment (CPQ8r and CPQ8i) compared with the noncompliant patients (Figure 2).

The parents' perspectives of impairment in the child's EW (EW:P) and SW (SW:P) were higher in compliant compared with noncompliant patients with a small effect size ($P = .017$ and .022, $r = 0.272$ and 0.261, respectively; Figure 3). A high correlation between the parents' perspectives of the child's EW and SW was present ($r = 0.771$; $P < .001$). There were no significant differences in other dimensions. However, PE were noted to be higher in compliant patients.

The univariate analyses using the Fisher exact test showed that the type of appliance had borderline

**Table 1.** Sample Description

| Variable | Median | Interquartile Range | Mean ± SD[a] | Minimum-Maximum |
|---|---|---|---|---|
| Age | 12 | 11–13 | 12.0 ± 0.9 | 11–13 |
| OJ | 8.0 | 7–10 | 8.4 ± 2.2 | 5–13 |
| Self-assessed oral health (0 = excellent, 4 = bad) | 2 | 1–3 | 2.3 ± 1.1 | 0–4 |
| Satisfaction with teeth appearance (0 = not at all, 4 = a lot) | 2 | 1–2 | 1.8 ± 1.0 | 0–4 |
| Child FL RSF | 0 | 0–2.5 | 1.7 ± 2.9 | 0–14 |
| Child SW RSF | 0 | 0–2 | 1.4 ± 2.1 | 0–9 |
| Child EW RSF & ISF[b] | 2 | 0–5.5 | 3.2 ± 3.8 | 0–16 |
| Child OS RSF & ISF[b] | 4 | 3–6.0 | 4.8 ± 2.8 | 0–13 |
| Child FL ISF | 2 | 0–4 | 2.7 ± 3.1 | 0–15 |
| Child SW ISF | 1 | 0–3 | 1.8 ± 2.2 | 0–11 |
| Child CPQ RSF 8 sum | 4 | 2–7 | 4.9 ± 4.1 | 0–20 |
| Child CPQ ISF 8 sum | 6 | 3.5–10 | 7.3 ± 5.3 | 0–30 |
| Parental OS | 4 | 2–7 | 5.1 ± 3.8 | 0–19 |
| Parental FL | 3 | 0–6 | 4.6 ± 5.7 | 0–25 |
| Parental EW | 1 | 0–6 | 4.1 ± 5.8 | 0–26 |
| Parental SW | 1 | 0–4 | 3.4 ± 5.1 | 0–24 |
| PE FIS | 1 | 0–2.5 | 1.7 ± 2.3 | 0–11 |
| Family activities FIS | 0 | 0–2 | 1.1 ± 2.0 | 0–11 |
| Family conflicts FIS | 0 | 0–1 | 0.7 ± 1.6 | 0–7 |
| Financial burden FIS | 0 | 0–0 | 0.1 ± 0.5 | 0–2 |

[a] SD indicates standard deviation; FL, functional limitations; and OS, oral symptoms.
[b] The same items from the RSF and ISF.

significance; 69% were noncompliant in the BJ appliance group, and 46% were noncompliant in the TB appliance group ($P = .061$). More girls than boys were noncompliant (51% vs 49%), but without statistical significance.

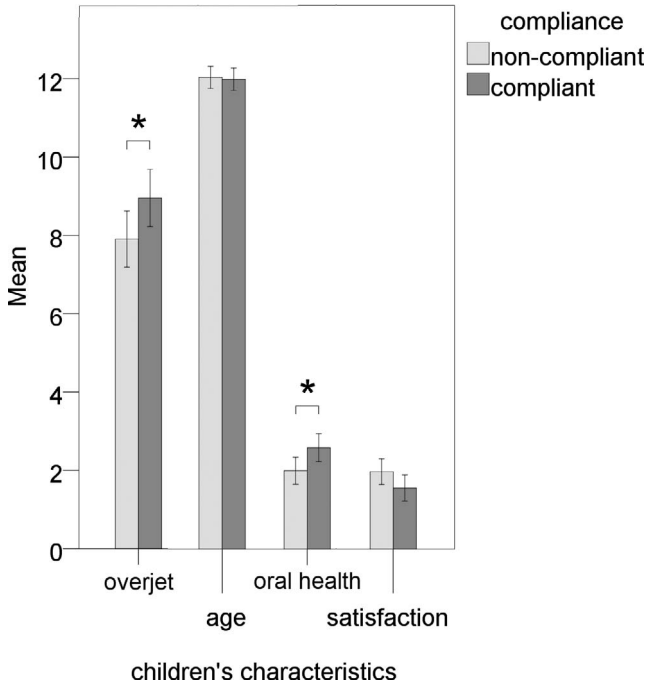


**Figure 1.** Comparison of characteristics of compliant and non-compliant children (oral health = child's self-assessment of oral health, satisfaction = child's self-reported satisfaction with teeth appearance). Bars represent means and 95% CIs. Significant differences between study groups are marked with parentheses and asterisk.

The multiple logistic regression analysis showed that OJ, type of appliance, and parental perception of alteration of the child's EW were the only significant predictors of compliance for functional orthodontic treatment of Class II/1 malocclusion during puberty (Table 2). Children's self-assessed oral health and teeth appearance satisfaction were not valid predictors. Parental perception of altered EW in their children

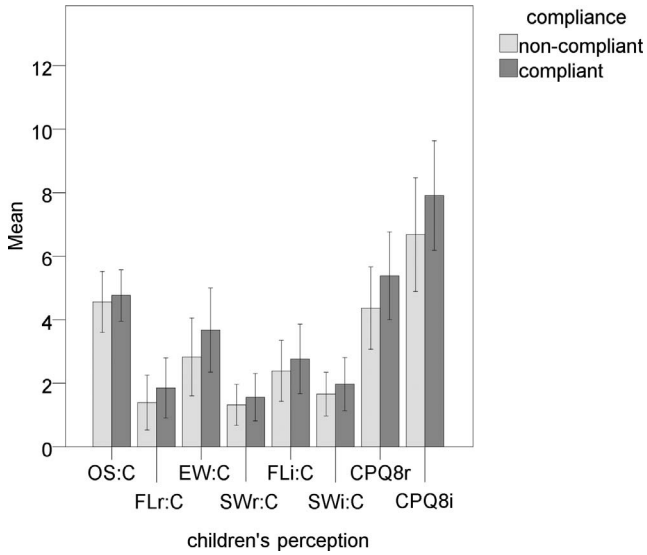


**Figure 2.** Comparison of alteration of quality of life reported by compliant and non-compliant children. CPQ8 indicates summary alteration of quality of life/short-form Child Perception Questionnaire (small letters r and i denote regression-impact and item-impact short-form questionnaires, respectively); FL:C, child perception of functional limitations; OS:C, child perception of oral symptoms; and SW:C, child perception of SW.

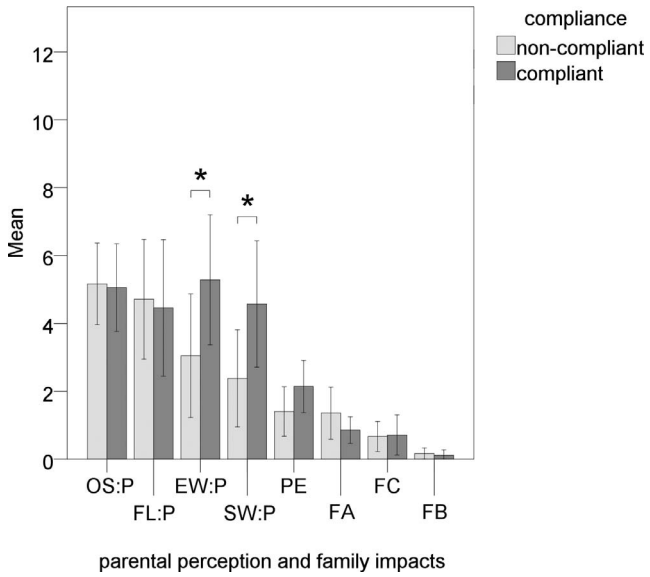


**Figure 3.** Comparison of parental perception of altered quality of life of their children and family impacts between compliant and noncompliant children. EW:P indicates parental perception of EW; FA, family activities; FB, financial burden; FC, family conflict; FL:P, parental perception of functional limitations; OS:P, parental perception of oral symptoms; and SW:P, parental perception of SW

was the strongest predictor, increasing compliance odds 3.4 times (95% CI, 1.2–9.4; $P = .017$). OJ equal to or greater than 8 mm increased compliance odds 3.1 times (95% CI, 1.0–9.4; $P = .044$). The TB appliance increased compliance odds 3.2 times (95% CI, 1.1–9.3; $P = .033$) compared with the Sander BJ appliance.

According to the multiple regression model that analyzed previously stated predictors, 64% of cases (80% of the compliant and 50% of the noncompliant patients) were classified as predictable. Although this indicated great data dispersal (large 95% CI), the model was still considered valid for compliance prediction because it predicted the majority of compliant patients.

## DISCUSSION

The purpose of this study was to determine factors that could predict Class II/1 patient compliance with TB and BJ appliances. Parents' perspective was found to be a compliance predicting factor, unlike psychosocial issues and oral functions reported by the children.

The study confirmed a high rate of noncompliance of Class II/1 pubertal patients treated with removable functional appliances (53% noncompliant vs 47% compliant). The patient cooperation problem with removable appliances has been well-documented, and some reported even higher rates of poor cooperation.[23] A systematic review and meta-analysis by Al-Moghrabi et al.[15] in 2017 stated that the actual wear was almost 6 hours per day less than recommended.

**Table 2.** Predictors of Compliance According to Logistic Regression[a]

| Variable | B | SE | *P* Value | OR (95% CI) |
|---|---|---|---|---|
| Parental EW (≥2) | 1.2 | 0.5 | .017 | 3.4 (1.2–9.4) |
| Appliance (1 = TB vs 0 = Sander) | 1.2 | 0.6 | .033 | 3.2 (1.1–9.4) |
| OJ ≥ 8 mm | 1.1 | 0.6 | .044 | 3.1 (1.0–9.4) |
| Constant | −3.0 | 0.9 | | |

[a] Negelkerke Pseudo $R^2 = 0.247$; $P = .001$. B indicates logistic coefficient; and SE, standard error.

Therefore, it was considered that both the patients that discontinued treatment self-willingly (17%) and those with no OJ reduction (83%), which probably fell into the category of suboptimal appliance wear, were noncompliant. Insufficient removable appliance wear could be attributed to a number of reasons, including discomfort[24] and embarrassment.[25] Younger and privately insured patients in Germany wore their appliances longer, but because patients fulfilled only 65% of the orthodontist's requirements concerning wear time, constant support and motivation is needed.[19]

English patients with larger initial OJ values (8 mm or greater) were three times more compliant. Although other issues reported by children did not show significant differences, compliant patients were less satisfied with the esthetics of their smile and had more functional limitations, disturbed EW, and overall quality-of-life impairment. Taking into consideration that patients commonly state dental and facial esthetics as their chief complaint, increased OJ might be considered a significant factor of internal motivation. It has been reported that the need to blend in with peers, avoid negative social experiences, and improve both physical well-being and EW increased the level of self-motivation for orthodontic treatment in adolescents. Consequently, compliance with the prescribed wear time is expected to be much better in highly self-motivated patients compared with those with no or low self-motivation.[18]

According to the multiple logistic regression analysis, the type of appliance was a significant compliance predictor for functional Class II/1 orthodontic treatment. Patients treated with the TB appliance were three times more compliant compared with those treated with the BJ appliance. One of the reasons might be the fact that the BJ appliance contained prongs that might impinge on tongue function. Al-Moghrabi et al.[15] used a meta-regression analysis to compare compliance with extraoral and intraoral appliances and found that it was not directly related to the type of the appliance. No studies comparing TB and BJ appliance compliance were found. However, similar clinical outcomes in Class II/1 malocclusion treatment during puberty have been reported regardless of the type of functional

appliance.[26,27] In addition, treatment success does not depend solely on cooperation; patient genetics, age, and morphological features play an important role. Condylar angle has been identified as the best predictor of favorable treatment response in mandibular deficiency patients.[28] Nevertheless, functional appliances appear to be a viable treatment option also in patients at the pubertal growth spurt exhibiting unfavorable skeletal growth patterns.[29]

Parents' perceptions of child's altered EW also improved compliance probability three times. Parents' perspectives of the child's EW and SW have high correlations and share large parts of the common variability, which is why, in the regression model, only EW turned out to be a significant unique predictor. Obviously, young adolescents find it difficult to express their concerns, but parents notice that the issues with which their children are dealing are emotional problems, which interplay with social integration. It was reported that malocclusion severity in puberty in Croatian patients was related to both psychosocial well-being and oral function. However, functional orthodontic treatment of Class II/1 malocclusion induced greater effect in the psychosocial rather than the oral function dimension.[30]

It appears that parents in England not only observed and understood their children's behavior but also that they had a positive influence on cooperation with removable appliances, particularly for those with inconsistent compliance levels.[18] When asked directly, Scandinavian adolescents pointed out several factors that helped them persevere in treatment, namely, receiving parental support and motivation and encouragement from the dentist and developing individual strategies such as using the thumb for measuring the change of OJ and using Post-it notes as a reminder to wear the appliance.[31]

The current results showed that sex had no influence on compliance, which is in line with the findings of Bartsch et al.[32] in the German population. On the other hand, Sahm et al.[33] and Schäfer et al.[19] reported German girls to be more compliant with removable orthodontic appliances, which was also expected to be observed in the current study.

The advantage of this study was that it used standardized questionnaires for the assessment of psychosocial and functional issues, taking into account children's and parents' perspectives and the role of family relationships. The shortcomings were that it did not directly ask patients what their reasons for poor compliance were and did not quantify the daily wearing of the appliance. Future studies should compare the change in the quality of life between compliant and noncompliant patients.

## CONCLUSIONS

- Parental perception of the child's EW alteration, severity of malocclusion, and type of appliance are major predictors of compliance.
- Patient compliance is better in patients whose parents perceive their EW impairment, those patients treated with the TB appliance, and those patients with initially larger OJ values.
- Psychosocial issues and oral functions reported by children and family impact are of negligible influence.

## ACKNOWLEDGMENTS

This study was financed by Universities of Rijeka and Osijek Grants 13.06.2.1.53, uniri-biomed-18-22 nad IP-9 and is registered at ClinicalTrials.gov (No. NCT03455634; "Predictors Associated With Seeking Orthodontic Treatment, Compliance and Treatment Success").

## REFERENCES

1. McNamara JA Jr. Components of Class II malocclusion in children 8-10 years of age. *Angle Orthod*. 1981;51(3):177–202.
2. Rosenblum RE. Class II malocclusion: mandibular retrusion or maxillary protrusion? *Angle Orthod*. 1995;65(1):49–62.
3. McNamara JA Jr, Peterson JE Jr, Alexander RG. Three-dimensional diagnosis and management of Class II malocclusion in the mixed dentition. *Semin Orthod*. 1996;2(2):114–137.
4. Pancherz H, Zieber K, Hoyer B. Cephalometric characteristics of Class II division 1 and Class II division 2 malocclusions: a comparative study in children. *Angle Orthod*. 1997;67(2):111–120.
5. Aggarwal P, Kharbanda OP, Mathur R, Duggal R, Parkash H. Muscle response to the twin-block appliance: an electromyographic study of the masseter and anterior temporal muscles. *Am J Orthod Dentofacial Orthop*. 1999; 116(4):405–414.
6. Barton S, Cook PA. Predicting functional appliance treatment outcome in Class II malocclusions—a review. *Am J Orthod Dentofacial Orthop*. 1997;112(3):282–286.
7. Bishara SE, Ziaja RR. Functional appliances: a review. *Am J Orthod Dentofacial Orthop*. 1989;95(3):250–258.
8. Clark W, Clark WJ. *Twin Block Functional Therapy*. New Delhi, India: JP Medical Ltd; 2014.
9. Sander F, Lassak C. The modification of growth with the jumping-the-bite plate compared to other functional orthodontic appliances. *Fortschr Kieferorthop*. 1990;51(3):155–164.
10. Sander F, Synodinos FN, Iglezos E, Sander M, Iglezou E, Sander C. The functional orthodontic-orthopedic VDP appliance (Vorschubdoppelplatte, Bite jumping appliance, Sander II). Literature review and typical clinical case presentation. *Hellenic Orthod Rev.* 2007;10(1).
11. Sander F. Functional processes when wearing a SII appliance during the day. *J Orofac Orthop*. 2001;62(4): 264–274.
12. Baccetti T, Franchi L, McNamara JA. The Cervical Vertebral Maturation (CVM) method for the assessment of optimal

treatment timing in dentofacial orthopedics. *Semin Orthod*. 2005;11(3):119–129.
13. Perinetti G, Primozic J, Franchi L, Contardo L. Treatment effects of removable functional appliances in pre-pubertal and pubertal Class II patients: a systematic review and meta-analysis of controlled studies. *PLoS One*. 2015;10(10): e0141198.
14. Brumini M, Slaj M, Katic V, Pavlic A, Trinajstic Zrinski M, Spalj S. Parental influence is the most important predictor of child's orthodontic treatment demand in a preadolescent age. *Odontology*. 2020;108(1):109–116.
15. Al-Moghrabi D, Salazar FC, Pandis N, Fleming PS. Compliance with removable orthodontic appliances and adjuncts: a systematic review and meta-analysis. *Am J Orthod Dentofacial Orthop*. 2017;152(1):17–32.
16. Schott TC, Meyer-Gutknecht H, Mayer N, Weber J, Weimer K. A comparison between indirect and objective wear-time assessment of removable orthodontic appliances. *Eur J Orthod*. 2016;39(2):170–175.
17. Mandall NA, Matthew S, Fox D, Wright J, Conboy FM, O'Brien KD. Prediction of compliance and completion of orthodontic treatment: are quality of life measures important? *Eur J Orthod*. 2008;30(1):40–45.
18. El-Huni A, Colonio Salazar FB, Sharma PK, Fleming PS. Understanding factors influencing compliance with removable functional appliances: a qualitative study. *Am J Orthod Dentofacial Orthop*. 2019;155(2):173–181.
19. Schäfer K, Ludwig B, Meyer-Gutknecht H, Schott TC. Quantifying patient adherence during active orthodontic treatment with removable appliances using microelectronic wear-time documentation. *Eur J Orthod*. 2015;37(1):73–80.
20. Jokovic A, Locker D, Guyatt G. Short forms of the Child Perceptions Questionnaire for 11-14-year-old children (CPQ11-14): development and initial evaluation. *Health Qual Life Outcomes*. 2006;4:4.
21. Jokovic A, Locker D, Stephens M, Kenny D, Tompson B, Guyatt G. Measuring parental perceptions of child oral health-related quality of life. *J Public Health Dent*. 2003; 63(2):67–72.
22. Locker D, Jokovic A, Stephens M, Kenny D, Tompson B, Guyatt G. Family impact of child oral and oro-facial conditions. *Community Dent Oral Epidemiol*. 2002;30(6): 438–448.
23. Cirgic E, Kjellberg H, Hansen K. Treatment of large overjet in angle Class II: division 1 malocclusion with Andresen activators versus prefabricated functional appliances-a multicenter, randomized, controlled trial. *Eur J Orthod*. 2016;38(5):516–524.
24. Lin F, Sun H, Ni Z, Zheng M, Yao L. A feasible method to improve adherence of Hawley retainer in adolescent orthodontic patients: a randomized controlled trial. *Patient Prefer Adherence*. 2015;9:1525–1530.
25. Kadkhoda S, Nedjat S, Shirazi M. Comparison of oral-health-related quality of life during treatment with headgear and functional appliances. *Int J Paediatr Dent*. 2011;21(5): 369–373.
26. Spalj S, Mroz Tranesen K, Birkeland K, Katic V, Pavlic A, Vandevska-Radunovic V. Comparison of Activator-Headgear and Twin Block treatment approaches in Class II division 1 malocclusion. *BioMed Res Int*. 2017;2017: 4861924.
27. Batista KB, Thiruvenkatachari B, Harrison JE, O'Brien KD. Orthodontic treatment for prominent upper front teeth (Class II malocclusion) in children and adolescents. *Cochrane Database Syst Rev*. 2018;3:CD003452.
28. Franchi L, Baccetti T. Prediction of individual mandibular changes induced by functional jaw orthopedics followed by fixed appliances in Class II patients. *Angle Orthod*. 2006; 76(6):950–954.
29. Baccetti T, McNamara JA Jr. The impact of functional jaw orthopedics in subjects with unfavorable Class II skeletal patterns. *Prog Orthod*. 2010;11(2):118–126.
30. Acev DP, Brumini M, Šlaj M, Katić V, Špalj S. Child Perceptions Questionnaire in Croatia: two domains for measuring oral health. *Acta Stomatol Croat*. 2019;53(1): 47–54.
31. Čirgić E, Kjellberg H, Hansen K. Discomfort, expectations, and experiences during treatment of large overjet with Andresen Activator or prefabricated functional appliance: a questionnaire survey. *Acta Odontol Scand*. 2017;75(3):166–172.
32. Bartsch A, Witt E, Sahm G, Schneider S. Correlates of objective patient compliance with removable appliance wear. *Am J Orthod Dentofacial Orthop*. 1993;104(4):378–386.
33. Sahm G, Bartsch A, Witt E. Reliability of patient reports on compliance. *Eur J Orthod*. 1990;12(4):438–446.