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# Research Paper: The impact of growth modification therapy on oral health related quality of life of adolescents: A survey during the COVID-19 pandemic

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## ABSTRACT

**Introduction:** This cross-sectional research compares the changes in quality of life (QoL) in adolescents experiencing growth modification therapy affected by the COVID-19 pandemic from 2019 to 2020. The participants were among those referring to the orthodontic department of Hamadan Dental School. The aim of this study was to evaluate the effect of growth modification on oral health related quality of life of adolescents during the COVID-19 pandemic.

**Materials and Methods:** This cross-sectional study was conducted from July 2020 to March 2021. The participants included 34 individuals (18 boys and 16 girls) with skeletal class II cases aged 10-13 years old undergoing removable growth modification treatment in Hamadan university of medical sciences. We measured the oral health-related quality of life (OHRQoL) before therapy and six months later. Persian translation of the Oral Health Impact Profile (OHIP-14) survey was employed to assess the OHRQoL. Data were analyzed by paired t-test, Pearson correlation coefficients, and T-test at a P-value of 0.05.

**Results:** Total OHIP did not show significant changes in any domains of functional limitation, social disability, mental disability, mental distress, physical pain, physical disability, and social disability during 6 months (ANOVA test P = 0.05).

**Conclusion:** Growth modification in adolescents with class II malocclusion did not show a significant short-term impact on patients' QoL within the first 6 months of therapy.

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## Introduction

The concept of oral health-related quality of life (OHRQoL) in orthodontics explains the difference in the professional and patient-determined necessity for orthodontic therapy.(1) OHRQoL is a patient-oriented outcome that improves the knowledge about the relationship between general health and oral health.(2)The OHRQoL is concerned with the potential impact of oral conditions on people's health, daily functions, and quality of life (QoL).(3) The Oral Health Impact Profile (OHIP-14) is a scale composed of 14 items developed for measuring self-reported discomfort, disability, and functional limitation related to oral conditions.(4) This scale has been extracted from an extended version with 49 items (5), designed according to a theoretical model proposed by the World Health Organization (WHO).(6) This model has been adapted for oral health by Locker.(7) OHRQoL measurement guides professionals in clarifying the oral health role and status on the overall QoL.(8) Currently, it is a critical outcome indicator for evaluating healthcare treatment and interventions, perception of the disease burden, identifying inequalities related to health, and allocation of health resources. OHRQoL instruments in clinical practice can be beneficial to recognize and prioritize health problems for patients, facilitate communication between healthcare staff and patients, and identify unexpected or hidden health problems. This instrument is used to improve decision-making, monitor changes in patients' health state precisely, and detect the responses for treatment properly.(9)

COVID-19 pandemic, originally observed in Wuhan, Hubei Province, China, has been present since 2019 with unknown etiology .(10) Quarantine imposed in the COVID19 outbreak (11) has been accompanied by adverse psychological impacts, including confusion, anger, and post-traumatic stress symptoms.(12) This pandemic also negatively affected the QoL of patients with lower HRQoL, particularly adolescents.(13)Although QoL improvement is regarded as an important objective of orthodontic treatment, it has been found that patients should tolerate some undesirable treatment-related side effects when using orthodontic appliances for achieving QoL enhancement.(14) As reported by some researchers, OHRQoL is worsened within the elementary period of the treatment, although it is considerably improved afterward .(15-17) It has been evidenced that QoL is influenced by orthodontic treatment, and the magnitude of the negative effect is associated with the received treatment.(18)Although growth modification with functional appliances can treat skeletal malocclusions, there is scarce research on the changes in the QoL following this treatment during the COVID-19 pandemic. This study was started before the COVID-19 pandemics. After patient enrollment, the pandemics began. Therefore, we aimed to assess this issue in pandemic circumstances. Therefore, this prospective study attempted to evaluate the effect of twin block appliances on patients' QoL during a worldwide COVID-19 outbreak.

## Materials and Method

In this cross-sectional observational research, we evaluated OHRQoL in individuals referring to the orthodontic department of Hamadan Dental School in 2019-2020.

The inclusion criteria were:

1. Moderate Class II division 1 malocclusion with mandibular deficiencies, point A-Nasion-point B (ANB) angle of 5-8°, and overjet of 4-8 mm
2. Presence of no systemic health problem
3. Age: 10 to 13 years old
4. Short face or normal face
5. No history of extraoral, removable, or fixed orthodontic appliances

The exclusion criteria were:

1. Severe skeletal Class II cases needing orthographic surgery (ANB > 8° or overjet > 8mm) or patients with maxillary prognathism who need growth inhibition of maxilla
2. Syndromic patients or patients with severe dentofacial deformities like cleft lip and/or



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palate

3. The unwillingness of patients to therapy compliance .(19) Power and Sample Size Calculations software, version 3.1.2, was used for calculating sample size (D. Plummer, Vanderbilt Medical Center, Nashville, 34), with the power of 80%, type 1 error of 0.05, and SD = 1, for finding mean difference as 0.025.

After explaining the research protocol to patients and their representative authorities, they completed an informed consent form. The declaration of Helsinki on the Medical protocol and science is followed in the present study. The study was confirmed by Medical and Ethics Committee of Hamadan University of Medical Sciences (IR.UMSHA.REC.1399.656)

The OHIP 14 scale used for measuring the OHRQoL is composed of 7 domains: functional limitation, psychological disability, physical pain, psychological discomfort, physical disability, handicap, and social disability. The questionnaire was completed by participants in their preferred language (20-21) before implementing the treatment as a baseline (T0). It was also completed 6 months after the delivery of the appliances (T1). OHIP 14 was scored based on a Likert scale: never = 1 (lowest), hardly ever = 2, occasionally = 3, fairly often = 4, and very often (highest) = 5. The age and gender effects were also analyzed during six months.

The Persian version of OHIP-14 was used in this research. The validity and reliability of the tool have been confirmed previously.(22) The final outcomes of the questionnaire were assessed by collecting answers to the questions. Higher and lower scores indicate poorer and better QoL, respectively.

### *Statistical analysis*

Data analysis was done using SPSS software (version 23, IBM Corp., Armonk, N.Y., USA). Also, descriptive statistics with paired T-test was used to analyze the obtained data. Finally, the QoL changes in patients were assessed longitudinally. Participants were compared by an independent T-test. Pearson Correlation Coefficient was used for assessing the effect of age and gender. Significance level was considered as 5% ($\alpha = 0.05$)

## Results

Sixty-four patients with class II malocclusion were referred to the orthodontic department, of which 34 (18 men and 16 women) met the eligibility criteria. The observation period lasted about 6 months.

Mean OHPI14 scores before therapy (T0) and 6 months after therapy (T1) in all 7 domains and the significance level are given in Table 1. An improvement was observed in the overall OHRQoL pattern during 6 months relative to the base time (T0), except in Functional limitation and Physical disability. Nevertheless, changes observed at all time points did not reach a significance level.

Table 1: Total and individual scores of OHIP14 by research group over 6 months

| | T0 | T 1 | P value |
|---|---|---|---|
| | Mean±(SD) | Mean(±SD) | Domain |
| Total OHIP14 Score | 23.44(6.72) | 21.70(5.90) | 0.160 |
| Functional limitation | 2.88(1.24) | 3.14(1.28) | 0.299 |
| Physical pain | 3.79(1.87) | 3.41(1.43) | 0.200 |
| Psychological discomfort | 4.38(2.23) | 3.76(1.63) | 0.187 |
| Physical disability | 2.58(.89) | 2.85(1.70) | 0.364 |
| Psychological disability | 3.88(1.88) | 3.44(1.35) | 0.218 |
| Social disability | 2.70(.97) | 2.38(.69) | 0.070 |
| Social handicap | 3.26(1.62) | 2.70(.87) | 0.084 |

Mean (±SD) and T-test over 6 months with T0 as base time (Scale for scores:1= never, 2= hardly ever, 3= occasionally, 4= fairly often, 5= very often); the significant level is $p < 0.05$.

### *Effect of aging*

The mean age of the patient at the start of treatment was 11.8 ±2.5, and follow-up was 6 months. The total OHIP score decreases with age, but the Pearson correlation coefficient indicates a weak correlation between age and the total score.

### *Effect of gender*

Overall means of OHIP14 score was greater in girls at T0 and T1 than boys. However, the comparison of the means of total OHPI14 scores in girls and boys shows no significant difference before and after treatment except in the social handicap domain (Table 2). The social handicap Domain at T0 showed a greater disability in girls before treatment than boys (P= 02).

Table 2: Individual and total OHIP14 scores by gender over 6 months

| | | Female | Male | P-value |
|---|---|---|---|---|
| | | Mean (±SD) | Mean (±SD) | |
| Total OHIP14 Score | T0 | 24.05(8.01) | 22.75(5.07) | 0.580 |
| | T1 | 22.27(6.21) | 21.06(5.65) | 0.557 |
| Functional limitation | T0 | 2.88(1.13) | 2.87(1.40) | 0.975 |
| | T1 | 3.27(1.48) | 3.00(1.03) | 0.537 |
| Physical pain | T0 | 3.72(1.93) | 3.87(1.85) | 0.816 |
| | T1 | 3.27(1.40) | 3.56(1.50) | 0.572 |
| Psychological discomfort | T0 | 4.38(2.30) | 4.37(2.15) | 0.986 |
| | T1 | 3.88(1.71) | 3.62(1.58) | 0.646 |
| Physical disability | T0 | 2.61(.97) | 2.56(.81) | 0.877 |
| | T1 | 3.00(1.71) | 2.68(1.74) | 0.602 |
| Psychological disability | T0 | 3.88(2.24) | 3.87(1.45) | 0.983 |
| | T1 | 3.55(1.54) | 3.31(1.13) | 0.609 |
| Social disability | T0 | 2.88(1.13) | 2.50(.73) | 0.249 |
| | T1 | 2.50(.78) | 2.25(.57) | 0.304 |
| Social handicap | T0 | 3.83(1.85) | 2.62(1.02) | 0.028 |
| | | 2.77(.87) | 2.62(.88) | 0.617* |

*ANOVA TEST

## Discussion

COVID-19 pandemic seems to be associated with the stressful situation in adults.(23) However, according to our research, there are no studies concerning the impact of the COVID-19 pandemic on the QoL of children undergoing orthodontic therapy. Evidence has shown a significant enhancement in OHRQoL and patient satisfaction at the end of the treatment period of fixed orthodontics.(24-25) In addition, few studies have examined QoL changes after treatment with functional appliances. The purpose of this descriptive cross-sectional research was to assess changes in QoL in adolescents experiencing growth modification treatment during the COVID-19 pandemic.

This study showed that applying functional appliances for 6 months had no significant effect on improving or worsening QoL in adolescents. In contrast to our study, Alzoubi stated that OHRQoL was significantly improved with both fixed and functional appliances.(19) According to Djokovic et al, the mean scores of CPQ11–14 (The Child Perceptions Questionnaire for children aged 11 to 14 years) in functional limitation and psychosocial well-bitingness domains in children with malocclusion were lower than children with normal occlusion.(26) Also, Masood et al. claim that people who have more overjet experience a weaker OHRQoL than those with a normal overjet.(27) On the other hand, QoL may not be adversely affected in people with severe malocclusion, while individuals with trivial irregularities stated lower QoL.(28) Such differences could be due to the problem severity, cultural differences, and differences in orthodontic appliances. In addition, concurrent with this study, the COVID-19 pandemic started, and the schools were suspended and continued to be online. As a result, children were quarantined in their homes to reduce the number of new COVID19 cases.

Quarantine may have substantial, long-term, and wide-ranging psychological effects on people. Also, there is an association between longer quarantine and poorer psychological consequences.(12) The children were quarantined in houses and judged by their parents. In this respect, parents could interpret the emotional functions of children in a biased manner such that children under the influence of parents' mood report lower scores.(29) According to Kitamura, the judgment of the emotional temperament of children is associated with assessment bias resulting from parents' emotions, like depression and anger. Consequently, psychological projection of hostile or negative feelings of parents onto their children is probable [30]. COVID-19 pandemics would change both positive and negative effects of orthodontic therapy on QoL. Suspension of schools and the necessity of wearing a mask may decrease the negative social impact of removable appliances. Additionaly, Hidening lower anterior face with a mask when wearing removable appliances

may lower the negative social impact of judging by their peers and improve QoL Meanwhile, the increased emotional stress caused by the COVID-19 outbreak would limit the positive impact of orthodontic treatment on QoL.

***Speech***

According to previous studies, individuals who use removable appliances had more problems regarding their speech under the treatment period. This issue negatively affected leisure activities and school work.(31-32) Self-image dissatisfaction can explain the relationship between increased overjet and scores of CPQ11-14 (i.e., the short form of the Child Perceptions Questionnaire for 11-14-year-old children) scores, principally in the social well-being area. This domain's items deal with issues concerning social relations, like avoiding indicating your teeth, laughing, and talking with family members or other children at school.(33) However, our study did not show any change in these relations.

The research findings indicated that using removable functional appliances causes an increase in the scores associated with patients' functional limitations and speech. However, it was not a statistically significant effect. Besides, these appliances change and decrease the space inside the mouth. Therefore, the expression of specific speech sounds by the tongue is prevented. Additionally, speech problems in individuals who use removable appliances could negatively affect leisure activities and school work.(34) The insignificant elevation scores related to functional limitation can be explained by quarantine.

***Physical pain***

Physical pain did not change significantly during the follow-up. As reported by Chen et al.(35) functional limitations and physical pain were greatly influenced in the first week after placement of the appliance. Nevertheless, these parameters were enhanced over 6 months. Forgetting the difficulty encountered by the patients at first weeks and starting fixed orthodontic treatment may be another reason in this regard.

***Gender***

The present study showed a significant difference between females and males in Social handicap domains at the start of treatment. According to studies, women can experience a lower QoL than men.(25-35) and are at higher risk of depression during COVID-19.(36) As reported by Kurtz, women act better in expressing the features of the experiences they face than males.(37-38) Alzoubi reported a more negative impact on OHRQoL in women with the Twin Block appliances than men in specific areas, like embarrassment, functional disability, and self-awareness. The parents or guardians of male patients reported that they do not use the appliances as prescribed by their physician.(19)

Experiencing more social handicaps in girls such as less satisfactory Life or Inability to function than male patients before treatment in our study may be due to the proximity of girls to puberty. In this connection, age can also have an effect. According to Iranian society's values and cultural system in this age group, the father shows more sensitivity toward his daughter. He may consider himself more responsible for providing the material demands and paying attention to his daughter's social relations. Since the boy is more encouraged to accept his problems and cope with them, this is considered a characteristic of the boy's maturity. Therefore, the boy expresses his feelings and problems less. Overall, he considers expressing his concerns and paying attention to his appearance contrary to the characteristics and expectations of society and those around him.(39) Also, a greater concern of females with aesthetic-related and functional health issues can explain this issue. In adults, it has been already hypothesized that complaints related to health problems are fewer in males than females.(40)

***Age***

With the increasing age of patients, the total scores decreased insignificantly. Children at this age are more likely to be treated under parental pressure and often lack intrinsic motivation. But as children get older and reach adolescence, their anxiety and awareness increase, and they become more sensitive to this issue. In the meantime, entering puberty makes its impact better and more important.

In our study, the overall scores of patients

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treated with functional appliances had decreased over 6 months, although this rate was not significant, and their QoL did not improve or worsen. Children seem to be less concerned about appearance at a young age (dentofacial effect on appearance). Thus, their occlusion trivially affects QoL or does not have any impact. In other words, children did not already feel socially disabled that they now want to be better or get worse.

It is known that people from low socioeconomic classes are more vulnerable to different risk factors that affect their oral health. In addition, oral health contributes to the QoL in all social, psychological, and functional dimensions. Furthermore, the monthly income of the family and the mother's level of education significantly affect the QoL concerning oral health. Poorer scores were reported by children with lower household incomes and those whose mothers did not complete primary school.(41) On the other hand, OHRQoL can also be influenced by the home environment, particularly the family structure (children that do not live with biological parents).(42-44) A few participants did not show a significant change in QoL due to the need for orthodontic therapy. This pattern is present in both underdeveloped countries (e.g., Thailand and Nigeria) and more socially developed populations (e.g., Sweden, Canada, England, and Belgium).(45) Children between the ages of 11 and 12 look at the concept of health as a multidimensional category. Also, those between the ages of 11 and 14 evaluate their OHRQoL given its effects on their performance in daily life.(46) However, perceptions of QoL in children may not be accurate.

In general, the questionnaire's reliability and validity were checked for older ages and found that it may not accurately assess the OHRQL of children. Furthermore, this questionnaire may not be appropriate for children's understanding, and the child is not fully aware of the question. Overall, the results might be biased due to parents' guidance in children's responses. Hence, setting up a questionnaire for children and adolescents is necessary.

One of the research limitations was the incidence of the COVID-19 crisis. The presence of patients in the dental school was limited, and follow-up visits were not held regularly. Some patients did not want to attend due to the circumstances. We inevitably used an online questionnaire for follow-up. Nonetheless, the COVID-19 pandemic can affect well-being and mental health.(47) Due to the unavailability of caregivers, the risk of psychiatric disorders can arise. Generally, the probability of development of adjustment disorder, grief, and acute stress disorder was higher in children that experienced quarantine during the pandemic. The clinical criteria for post-traumatic stress disorder were observed in 30% of the children that experienced isolation or quarantine. Children experience considerable changes to their social infrastructure and daily routine due to the COVID-19 pandemic. Thus, children's level of perception and age must be considered.(48)

## Conclusion

In general, this study showed that using functional appliances did not significantly influence the QoL of patients during 6 months in the COVID-19 pandemic. Designing a more specific questionnaire for adolescents, addressing their special concerns, may be useful to assess this issue.

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None

***Authors' contributions***

**Mohammad Amin Nouroozi:** Conceptualization, Methodology, Writing - Review & Editing **Maryam Farhadian:** Writing - Original Draft, Data Curation, Supervision **Sepideh Soheilifar:** Resources, Investigation, Visualization

***Conflict of Interests***

No financial or other competing interest regarding this article.

***Ethical declarations***

Not applicable

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***Availability of data and material***

The datasets used and/or analyzed during the current study are available from the correspond-

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