THE INFLUENCE OF ALIGNERS ON THE CONDITION OF ORAL ORGANS AND TISSUES

Mehmani V.
Department of Orthodontics, assistant
Rustamov E.
Doctor of Philosophy in Medicine, Assistant
Huseynova R.
Department of Therapeutic c Dentistry Assistant
Azerbaijan Medical University
Baku, Azerbaijan
https://doi.org/10.5281/zenodo.17121596

Abstract

The study is devoted to examining the influence of aligners on the level of salivation, oral hygiene status, the occurrence of carious lesions, as well as the condition of the gingival mucosa, in comparison with orthodontic treatment using bracket systems.

Keywords: orthodontic treatment, aligners

One of the primary requirements for modern orthodontic treatment is aesthetics. Quite often, despite the obvious need for orthodontic intervention, adult patients refuse treatment precisely because of changes in the appearance of their smile [4]. This has led to the creation of aligners—transparent removable orthodontic trays that allow inconspicuous and relatively comfortable correction of dentoalveolar anomalies and deformities. In our country, aligners have appeared relatively recently. Patients show interest in this type of orthodontic care, but practitioners often approach such innovations with caution. At present, domestic literature contains little data on the impact of aligners on the condition of oral organs and tissues.

In this study, based on a group of 30 individuals aged 19 to 42 years, the effect of aligners was examined with regard to salivation rate, plaque index, the appearance of carious lesions (including white spot lesions), and the development of gingivitis. The comparison group included 28 individuals aged 17 to 38 years undergoing orthodontic treatment with fixed bracket systems.

All parameters were assessed according to the following schedule: before treatment, the day after treatment began, after 1 week, after 1 month, and subsequently at 1-month intervals during the first year of treatment; in the second year, assessments were performed every 2 months. The average treatment duration with aligners was 9–12 months, while treatment with bracket systems lasted 17–20 months.

For the evaluation of salivation, sialometry was performed according to the method of M.M. Pozharitskaya [3]. At baseline, the mean salivation rate in both groups was 0.39 ± 0.03 ml/min, corresponding to the norm and to average values reported by several authors [1, 2]. On the second day after treatment initiation, there was a sharp increase in salivation to 0.45 ± 0.034 ml/min in the aligner group and 0.43 ± 0.03 ml/min in the bracket group, which can be explained as a reflex protective reaction. The difference in favor of the aligner group is most likely due to the greater contact area of aligners with the oral mucosa and, consequently, the larger number of impulses transmitted to the brain.

After 2 weeks of treatment, salivation decreased to 0.41 ± 0.03 ml/min in both groups, although patients still subjectively reported an increased salivation rate. After 1 month, the salivation rate gradually decreased to 0.40 ± 0.03 ml/min in both groups, with no further subjective complaints of hypersalivation. By the beginning of the second month, salivation stabilized in patients treated with bracket systems and returned to baseline (0.39 ± 0.03 ml/min). In patients treated with aligners, salivation remained slightly elevated (0.40 ± 0.03 ml/min) throughout the entire treatment course, although patients no longer noticed it subjectively. This fact can apparently also be explained by the greater contact area of removable trays compared with conventional bracket systems.

To assess oral hygiene, the Turesky index (1970) was used. Its distinguishing feature is that it stains not only the vestibular but also the lingual surfaces of the teeth, and it evaluates all teeth rather than individual groups, providing a more accurate reflection of a patient's oral hygiene status. Before treatment, the average hygiene level in both groups ranged from 1.02 to 1.23.

However, after just 1 month of treatment, the Turesky index in the aligner group was 1.23 ± 0.15, while in the control group it increased to 1.85 ± 0.25. This difference is explained by the difficulty of maintaining individual oral hygiene with fixed orthodontic appliances. In patients with aligners, the main areas of plaque accumulation were around the composite attachments.

By the beginning of the third month, the index stabilized at 1.22 ± 0.18 in the aligner group. In the bracket group, it reached 2.30 ± 0.30, which is attributed to the appearance of various elastic ligatures at this stage, also contributing to plaque accumulation.

During further observation, there was a tendency for the index to increase in the bracket group over the course of a year to 2.4–2.45, while remaining stable at 1.15–1.22 in the aligner group. This further demonstrates the advantage of removable appliances for maintaining adequate oral hygiene and preserving a normal hygienic status.

One of the primary objectives of this study was to determine the influence of aligners on the development

of carious lesions. To track this, the DMF (Decayed, Missing, Filled) index was used. Observations showed an increase in the DMF index in patients treated with bracket systems (from 10.70 ± 5.11 to 11.41 ± 5.44), while patients in the aligner group remained relatively stable (from 6.83 ± 5.18 to 6.93 ± 5.24).

Since the DMF index accounts only for cavitated carious lesions, it is not informative regarding early forms of caries, which actively appear during orthodontic treatment. For this reason, the emergence of white spot lesions was tracked separately. At baseline (before treatment), 4 white spot lesions (0.47%) were found in the aligner group and 8 lesions (1%) in the comparison group.

During orthodontic treatment with aligners, 24 new white spots appeared, whereas 74 new spots were observed in patients treated with bracket systems. In the aligner group, lesions primarily appeared in the cervical region and on the approximal surfaces of teeth. In the bracket group, spots were most often located around brackets, in the cervical area, and on contact surfaces.

However, while the appearance of white spots in bracket-treated patients can be explained by difficulty maintaining oral hygiene and the presence of numerous retention points, in the case of removable aligners, it can be explained by the isolation of the enamel surface from saliva—the main source of ions necessary for remineralization.

The study examined the effect of aligners and fixed bracket systems on the development of gingivitis, based on the dynamics of the Plaque, Marginal, and Attachment (PMA) index in the Parma modification. According to the data, before treatment, the PMA index was 4.6 ± 1.0 in the aligner group and 5.5 ± 3.0 in the bracket group. This difference is explained by the greater crowding and degree of dental arch deformation in the second group.

During orthodontic treatment, starting from the first month, a negative trend in gingivitis was observed in both groups, with a clear predominance in patients treated with bracket systems. One month after treatment began, the PMA index in the aligner group was 5.8 ± 2.0, whereas in the bracket group it was 8.6 ± 4.0. By the third month, the index increased to 6.2 ± 2.0 in the aligner group and 14.1 ± 4.0 in the bracket group. This large difference can be attributed to more difficult oral hygiene maintenance and, consequently, poorer hygiene status in patients with brackets compared to the aligner group.

After 3 months of treatment, the PMA index stabilized in the aligner group, while it continued to increase in the bracket group (16.5 ± 5.0). By the end of the first year of treatment, the PMA index in the control group reached 20.7 ± 6.0 (Table 5). Thus, in the bracket group, the index increased nearly fourfold compared to baseline, whereas in the aligner group the change was minimal. This can be explained, first, by the shorter duration of treatment and, second, by the higher hygienic properties of removable appliances.

Based on these observations, several conclusions can be drawn. First, removable dental trays—aligners—are more hygienic compared to conventional bracket systems. Because they are removable, patients can maintain individual oral hygiene more easily. In addition, orthodontic treatment with aligners involves fewer retention points on tooth surfaces, resulting in lower plaque accumulation. Since dental plaque is the main factor in the development of carious lesions and gingivitis, its formation is reduced when aligners are used.

Second, although aligners are a type of removable orthodontic appliance that facilitates individual oral hygiene, the appearance of white spot lesions is still observed due to the isolation of the tooth enamel surface from the remineralizing environment—saliva. Therefore, patients in this group require additional remineralization therapy during orthodontic treatment to prevent the development of caries.

Third, since aligners are worn for 20–22 hours per day, there is a constant presence of an irritant in the oral cavity, which can contribute to the development of gingivitis. Consequently, it is recommended that patients using aligners, as well as those with conventional bracket systems, use various oral rinses to prevent gingivitis and other inflammatory conditions of the oral cavity.

References:

1. Petrishchev N.N., Orekhova L.Yu. Klinicheskaya patofiziologiya dlya stomatologov: Uchebnoe posobie. Saint Petersburg, 2002. 109 p.

2. Petrova N.P. Issledovanie vliyaniya ortodonticheskikh apparatov na adaptivnye svoistva rotovoi zhidkosti u detei i podrostkov. Avtoref. diss. kand. med. nauk. Saint Petersburg, 2003. 18 p.

3. Pozharitskaya M.M., Makarova O.V. Sekretsiya i fiziologicheskie funktsii smeshannoi slyuny v norme. Metod. rekomendatsii. Moscow, 1996. 17 p.

4. Malik OH, McMullin A, Waring DT. Invisible orthodontics part 1: invisalign Dent Update, 2013, apr., vol. 40, no 3, pp. 203—204, 207—210, 213—215.