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Lingual ve Labial Sabit Ortodontik Aygıtların Etkilerinin Karşılaştırılması: Retrospektif Çalışma

Comparison of the Effects of Lingual and Labial Fixed Orthodontic Appliances: A Retrospective Study

Fixed Orthodontic Appliances

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ÖZET

Amaç: *Bu çalışmanın amacı, lingual ve labial sabit ortodontik aygıtların hasta konforu ve günlük yaşam üzerindeki etkilerini karşılaştırmaktır.*

Gereç ve Yöntem: *Toplam 30 hasta, aygıt tipine göre iki grup olarak değerlendirildi. Grup 1'de 9 kadın, 6 erkek toplam 15 hastaya lingual braket, Grup 2'de 8 kadın ve 7 erkek toplam 15 hastaya labial braket uygulandı. Tüm hastaların 1. gün (T0) 7. gün (T1) ve 14. günlerde doldurulan anket formları değerlendirildi. Ağrı düzeyi, konuşma güçlüğü, dil travması, yeme güçlüğü, fırçalama güçlüğü, dişlerdeki düzelmenin ilk farkedilme zamanı, sosyal çevre tepkisi, tedavi memnuniyeti ve tedavi gerekliliği parametreleri anket formlarındaki 1'den 10'a kadar puanlanan değerlere göre incelendi. Verilerin istatistiksel analizleri tek yönlü Anova, Welch'in t-testi ve eşleştirilmiş örneklem t-testi ile yapıldı.*

Bulgular: *T0 döneminde ağrı düzeyi ve fırçalama güçlüğü açısından gruplar arasında anlamlı fark bulunmazken ($p>0,05$), Grup 1'in konuşma güçlüğü, dil travması ve yeme güçlüğü değerleri Grup 2'ye göre daha yüksek bulundu ($p<0,05$). Ağrı düzeyi ve konuşma güçlüğü açısından T0-T1, T0-T2 ve T1-T2 dönemleri arasında anlamlı düşüşler gözlendi ($p<0,05$).*

Sonuç: *Lingual braketler özellikle tedavinin ilk günlerinde daha fazla dil travmasına, konuşma ve yeme güçlüğüne neden oldu. Her iki apareyde de rahatsızlıkların zamanla azaldığı görüldü.*

Anahtar Kelimeler: *Lingual ortodonti, Labial ortodonti, Anket, Karşılaştırma*

ABSTRACT

Objective: *The aim of this study is to compare the effects of lingual and labial fixed orthodontic appliances on patient comfort and daily life.*

Materials and Methods: *A total of 30 patients were evaluated in two groups according to device type.*

In group 1, lingual brackets were applied to fifteen patients including 9 female and 6 male and in group 2 labial brackets were applied to fifteen patients including 8 female and 7 male. Questionnaire forms answered by the patients on the first (T0), seventh (T1) and fourteenth (T2) days of the treatment were evaluated.

Parameters related with pain level, speech difficulty, tongue trauma, eating difficulty, brushing difficulty, time to first notice of aligning in teeth, social environment reaction, treatment satisfaction and necessity of treatment were examined according to the values marked on a scale from 1 to 10 in the questionnaire forms. Statistical analyzes were performed with one-way Anova, Welch's t-test and paired-sample t-test.

Results: *While in T0 period, there was no significant difference between the groups in terms of pain level and brushing difficulty ($p>0.05$), the tongue trauma speech and eating difficulti values of Group 1 were found higher than Group 2 ($p<0.05$). Significant decreases were observed between T0-T1, T0-T2 and T1-T2 periods in terms of pain level and speech difficulties ($p<0.05$).*

Conclusion: *Lingual brackets caused more tongue trauma, speech and chewing difficulties especially in the first days of the treatment. It was observed that the discomforts were decreased over time with both appliances.*

Keywords: *Lingual orthodontics, Labial orthodontics, Questionnaire, Comparison*

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Introduction

Orthodontic malocclusions have effects on appearance, aesthetics, smile, socio-psychological and general quality of life. For this reason, there is a significant increase in the number of patients demanding orthodontic treatment.[1] Orthodontic treatments performed with modern fixed orthodontic appliances are applied by means of fixed orthodontic mechanics adhered to the labial or palatinal areas of the teeth. The rejection of traditional labial orthodontic mechanics by the adult population due to their unaesthetic appearance has paved the way for the development of aesthetic devices such as aesthetic brackets, invisible aligners and lingual orthodontics.[2] The aesthetic demands with orthodontic treatment have been increasing over the years not only as a treatment goal, but also for the continuation of their aesthetic appearance during the treatment of the patients.

Orthodontic malocclusions can be treated with both lingual and labial orthodontic mechanics. Also, it is very important to carefully selected patients for whom lingual orthodontic treatment is planned. While teeth with long and flat lingual surfaces are appropriate for lingual orthodontic appliances; patients with short lingual surfaces or teeth with double cusps, periodontally poor gums and carious teeth, low tolerance and low oral hygiene motivation are not appropriate.[3]

The lingual technique, which first emerged in the United States of America (USA) in the 1970s, was very popular in the early 1980s, but has been widely used in Europe and Asia for the last ten years, although its popularity has decreased with the introduction of ceramic brackets.[4] A variety of aesthetic lingual orthodontic appliances emerged in the 1980s, with the understanding that due to the deterioration of the facial appearance of traditional labial orthodontic treatments are a major concern for patients.[2] Lingual orthodontic treatment, which allows the refinement of malocclusion through fixed devices applied to the lingual areas of the teeth, offers higher aesthetics compared to labially bonded orthodontic devices, with the increase in aesthetic demands.

With the increase in orthodontic treatment demands in the adult population, lingual orthodontic mechanics has become a solution to the problems related to the appearance of orthodontic appliances, even in highly motivated patients.[5] However, in studies on the attitudes and discomforts of patients, it has been reported that after placement of lingual orthodontic treatment devices, it cause various complaints such as temporomandibular joint (TMJ) problems, chewing and speech difficulties, and tongue traumas due to changes in the morphology of the teeth.[6]

In lingual orthodontics, the distance between brackets is narrower and due to the fact that the brackets are near to the resistance center of the teeth, tipping movement is less common, while bodily movement is achieved more.[7] These differences can lead to more forces during leveling and alignment, which increases the risk of root resorption due to uncontrolled forces and moments, especially during settling.[8] However, it has been reported that lingual orthodontics can lead to various clinical outcomes, such as decreased in overbite and axial inclination of upper central incisors, and uncontrolled torque compared to labial orthodontics.[8] In addition, while previous studies reported advantages such as less visibility of lingual orthodontic treatment, the use of lighter forces in the treatment due to the narrower interbracket distance, and better anchorage control, disadvantages such as more difficulty in placement procedures, prolonged chair time and high laboratory costs has also been reported.[1,9]

In the presented retrospective study, it is aimed to evaluate and compare the effects of lingual and labial orthodontic appliances in the archive records on comfort and daily life by examining the questionnaire data filled in the T0 (1st day), T1 (7th day) and T2 (14th day) periods.

Materials and Methods

Study Design and Ethics

The study was designed as a retrospective single-center study that included the evaluation of questionnaires filled in T0 (1st day), T1 (7th day) and T2 (14th day) periods of patients using lingual and labial fixed orthodontic appliances. In the study, in which archive records of 30 patients were evaluated; lingual brackets were used in Group 1, a total of 15 patients, 9 girls and 6 boys, and a total of 15 patients, 8 girls and 7 boys, in Group 2, where labial brackets were used. The study was conducted with the approval of the Ethics Committee of

the Bülent Ecevit Üniversitesi (18/11/2020:2020-22).

Patient Selection

A total of 30 patients in the archive records, 17 girls and 13 boys, who were treated in the Department of Orthodontics, of Dental Faculty of UBE, were included in the study. The inclusion criteria of the patients in both groups [Group 1 (n=15) and Group 2 (n=15)] were the same. Then, after scanning the archive records considering the patients who met the following criteria were included; dental Class 1 malocclusion, mild anterior crowding (≤3mm), normal overjet and overbite, no skeletal problems, no systemic diseases, and good oral hygiene with no periodontal problems.

Table I. Distribution of study groups

	Grup 1 (Lingual Bracket Group)		Grup 2 (Labial Bracket Group)	
Sex	Female	Male	Female	Male
	9	6	8	7
Total	15		15	

Questionare

In the study, 9-question surveys, which were modified from the scales and questionnaires developed by Cline et al.(10), Abdulmajed (11) and Şahin (12), were evaluated. The patient records of T0 (1st day), T1 (7th day) and T2 (14th day) periods of patients who were applied Discovery® Delight (*Dentaurum, Inspringen, Germany) metal lingual brackets in Group 1 and Equilibrium® 2(Dentaurum, Inspringen, Germany*) metal labial brackets in Group 2 were analyzed separately. Questionnaire form records marked on a scale of 1 to 10, consisting of parameters such as pain level, speech difficulty, tongue trauma, eating difficulty, brushing difficulty, time to first notice of aligning in teeth, social environmental reaction, treatment satisfaction and necessity of treatment were carefully examined.

Statistical Analysis

Statistical analysis was performed using the R Statistics (version R-4.0.3; Vienna, Austria) program. One-way ANOVA and Welch's t-test were used for differences between groups, and paired-sample t-test was used to examine the differences in within-group variables according to periods. Statistically significant value was considered as p<0.05.

Results

While a significantly difference was found in the parameters of speech difficulty, tongue trauma and chewing difficulties between the groups in the T0 period (p <0.05); there was no significantly difference in pain level and brushing difficulty parameters (p> 0.05). Again, no statistically significant difference was found between the boys and girls in the T0 period in terms of pain level, speech difficulty, tongue trauma, difficulty in eating and difficulty in brushing (p> 0.05) (Table 2).

Table 2. Statistical analysis results of speech difficulty, tongue trauma and eating difficulty parameters in T0 period

Parameters		Df	Sum of squares	Mean of squares	F value	Significance value (p)
Speech difficulty	Sex – Gender	1	3.96	3.96	1.283	0.2
	Groups(Group 1 and 2)	1	55.56	55.56	18.011	0.001*
	Total	27	83.28	3.08		
Tongue trauma	Sex – Gender	1	24.13	24.13	3.662	0.06
	Groups(Group 1 and 2)	1	26.61	26.61	4.038	0.04*
	Total	27	177.92	6.59		
Eating difficulty	Sex – Gender	1	0.03	0.03	0.006	0.9
	Groups(Group 1 and 2)	1	32.32	32.32	5.930	0.02*
	Total	27	147.15	5.45		

* p< 0,05

In the T0 period, in three parameters namely speech difficulties, tongue trauma and chewing difficulties were found to be statistically significantly higher in lingual group than in labial group (p <0.05). Additionally, there was no statistically significant difference between Group 1 and Group 2 in pain level and brushing difficulty parameters (p> 0.05) (Table 3).

Table III. Statistical analysis results of pain level, speech difficulty, tongue trauma, chewing difficulty and brushing difficulty parameters at T0 period

Parameters	t	df	Significance value (p)
Pain level	-0.5022	27.539	0.6
Speech difficulty	-4.0855	27.986	0.001*
Tongue trauma	2.0563	27.292	0.04*
Eating difficulty	-2.4662	22.61	0.02*
Brushing difficulty	-1.1383	22.39	0.2

* p< 0,05

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A significantly difference was found in the parameters of pain level, difficulty in speaking, difficulty in chewing and brushing in T0-T1, T0-T2 and T1-T2 periods (p< 0.05). In both groups; pain level, speech difficulty, tongue trauma, chewing difficulty and brushing difficulty parameters were found to be statistically significantly higher at T0 compared to T1, T0 compared to T2 and T1 compared to T2 (p< 0.05). There was no significantly difference between the groups and gender regarding the time of first notice of the aligning in teeth and social environment reaction (p> 0.05). While there was a statistically significant difference between the groups in terms of treatment satisfaction and the necessity of treatment (p< 0.05), no significantly difference was found between genders (p> 0.05). The parameters of satisfaction with treatment and necessity of treatment in Group 2 were found to be significantly higher than in Group 1 (p< 0.05) (Table 4 and Table 5).

Table IV. Statistical analysis results of the time to first notice of aligning in teeth, social environment response, treatment satisfaction and the necessity of treatment parameters

Parameters		Df	Sum of squares	Mean of squares	F value	Significance value (p)
First notice of aligning in teeth	Sex – Gender	1	2470	2470	1.045	0.3
	Groups(Group 1 and 2)	1	5887	5887	2,490	0.1
	Total	27	63831	2364		
Social environment response	Sex – Gender	1	0.0024	0.00241	0.038	0.8
	Groups(Group 1 and 2)	1	0.1364	0.13637	2.131	0.1
	Total	27	1.7279	0.06400		
Treatment satisfaction	Sex – Gender	1	0.1	0.10	0.027	0.8
	Groups(Group 1 and 2)	1	203.1	203.11	54.481	0.001*
	Total	27	100.7	3.73		
Necessity of treatment	Sex – Gender	1	4.00	4.002	1.570	0.2
	Groups(Group 1 and 2)	1	22.13	22.131	8.681	0.006*
	Total	27	68.83	2.549		

* p< 0,05

Table V. Statistical analysis results of the time to first notice of the aligning in the teeth, social environment reaction, treatment satisfaction and necessity of treatment parameters

Parameters	t	df	Significance value (p)
Time to first notice of the aligning in the teeth	1.4986	14.05	0.1
Social environment reaction	-1.4676	14	0.1
Treatment satisfaction	7.4956	26.777	0.001*
Necessity of treatment	-4.0855	27.986	0.004*

* p< 0,05

Discussion

Since orthodontic malocclusions have a notable impact on quality of life, the number of patients seeking orthodontic therapy is increasing day by day. However, it is also reported that the devices used during orthodontic treatments cause discomfort that will negatively affect patient compliance.[13] Although there are many studies on pain experienced during orthodontic treatments, there are limited studies investigating the effect of orthodontic therapy on quality of life. In this study, the effects of these techniques on comfort and daily life in patients who were applied lingual and labial fixed brackets were evaluated with retrospective questionnaire data.

Both lingual and labial orthodontic treatments are requested due to malocclusion complaint. Hardwick et al.[14] reported that patients demand lingual orthodontics as a result of more research and they expect the same quality of treatment as those who want labial orthodontic treatment, but those who request lingual orthodontic treatment have higher expectations. In the study, there was no significantly difference between gender in the parameter of necessity of treatment, while it was found to be significantly higher in labial group than in lingual group.

The perception of pain that occurs during orthodontic treatments is related to the release of inflammatory mediators in the periodontal gap and starts 2-3 hours after orthodontic procedures, peaks at 24 hours and decreases after 72 hours with individual variability.[15] Billaiya et al.[16] reported that the highest pain in lingual orthodontic treatment was after the placement of the first archwire,

and the pain intensified during eating, consuming hot-cold drinks, and sleeping. Tecco et al[17] noted that in the labial orthodontic treatments they performed with traditional and self-ligating brackets, the pain intensity reached the highest level after the first archwire placement in both groups, and then the pain decreased significantly over time, and there was no pain at the end of 7-9 days. Again, Wu et al.[18] mentioned that the general pain level observed in the first week, first month and third month in lingual and labial mechanics was similar in both groups and the pain decreased statistically significantly over time.

In the present study, there was no statistically significant difference in the pain level parameter between genders and groups in the T0 period. However, statistically significantly higher pain levels were found in both Group 1 and Group 2 compared to the following periods after the placement of the first archwire. Again, it was observed that the level of pain decreased statistically significantly over time in both Group 1 and Group 2.

In addition to the fact that one of the causes of speech problems is orthodontic malocclusion, it has been reported that lingual appliances affect the oral cavity and due to the range of motion of the tongue, causing some special sounds to be impaired. Rai et al[19] reported that speech difficulty started immediately after the placement of lingual and labial orthodontic appliances, lingual appliances caused statistically significantly more speech difficulties than labial appliances, lasted longer, and this difficulties decreased over time. Khattab et al[20] said that fixed lingual orthodontic appliances cause statistically significantly more speech difficulties than labial appliances. In the study, the speech difficulty parameter was found to be statistically significantly higher in Group 1 than in Group 2, and it was observed that this difficulty decreased over time.

One of the oral disorders caused by lingual orthodontic appliances is tongue traumas. Caniklioğlu et al[21] reported that lingual orthodontic appliances cause more tongue trauma than labial appliances. In addition, Shalish et al[22] reported that lingual orthodontic appliances caused more irritation on the tongue than labial appliances, and this irritation decreased statistically significantly over time. In the study, tongue trauma was found to be statistically significantly higher in Group 1 compared to Group 2 in the T0 period, and it was observed to decrease statistically significantly in the following periods.

Although it is stated in the literature that all orthodontic appliances can cause eating difficulties, it is reported that lingual appliances cause statistically significantly more chewing problems immediately after insertion than labial appliances. However, Rakhshan et al[23] underlined mild pain and discomfort while brushing but more severe during chewing during fixed orthodontic treatment. In the present study, eating difficulties were found to be statistically significantly higher in Group 1 than in Group 2 in the T0 period. A statistically significant decrease was observed in eating difficulties over time. In addition, no statistically significant difference was found between Group 1 and Group 2 in brushing difficulty.

Orthodontic malocclusions do not just affect physical appearance; at the same time, it can impair the quality of life by negatively affecting self-confidence, socialization, social environment relations and psychology. Ali et al[24], in their survey study involving adolescents, reported that only 29% of respondents thought they had malpositioned teeth and more than 60% thought they had perfect or near-perfect tooth alignment. In the same study, they reported that 75% of the participants thought they needed orthodontic treatment. Lee et al[25], in their study evaluating orthodontic treatment satisfaction, reported that boys reported statistically significantly higher satisfaction than girls in terms of overall satisfaction rate of 84.9% and treatment costs. Individuals treated with lingual appliances had more adverse oral experiences during the treatment period. Especially tongue trauma, difficulty in speaking, difficulty in eating, and changes in diet regimen were more common in individuals treated with lingual appliances compared to those treated with labial appliances.[26] In our study, there was no statistically significant difference between gender in terms of treatment satisfaction. However, when compared to Group 1, statistically significantly higher satisfaction difference was found in Group 2. It was thought that the higher level of treatment satisfaction in Group 2 resulted from the higher exposure of Group 1 individuals with the above-mentioned bad oral experiences. Moreover, there was no statistically significant difference among the groups and gender in the time of first notice of the

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aligningt in teeth and social environment response parameters. Both two groups indicated that they were welcomed by their social environment.

Conclusions

Within this study limits:

- Lingual orthodontic appliances cause more speech difficulties, tongue trauma and eating difficulties in the initial days,

- The level of pain and brushing difficulties were found to be similar in patients treated with both appliances,

- The conditions that caused discomfort in both appliances decreased significantly over time,

- It was observed that patients who treated labial orthodontic appliances thought they needed orthodontic treatment more and were more satisfied

- It is concluded that lingual and labial fixed orthodontic treatments are positively received by the social environment.

References

1. Behnaz M, Farahnaki A, Rahimipour K, Mousavi R, Davoodi NS. Lingual Orthodontic Treatment: Efficacy and Complications. J Advanced Oral Res. 2019;10(2):65-74.
2. Rosvall MD, Fields HW, Ziuchkovski J, Rosenstiel SF, Johnston WM. Attractiveness, acceptability, and value of orthodontic appliances. Am J Orthod Dentofac Orthop. 2009;135(3):276. e1-. e12.
3. Amasyali M, Uysal T. Lingual ortodonti. Cumhuriyet Dent J. 2009;12(1):67-77.
4. Favale ML, Fusco R, Lesti M, Horodynski M, Toni B. Lingual vs. Labial fixed orthodontic appliances: comparison of adverse effects. Webmed Centralcom. 2017:5 pages.
5. Haj-Younis S, Khattab TZ, Hajeer MY, Farah H. A comparison between two lingual orthodontic brackets in terms of speech performance and patients' acceptance in correcting Class II, Division 1 malocclusion: a randomized controlled trial. Dental Press J Orthod. 2016;21(4):80-8.
6. Hohoff A, Seifert E, Fillion D, Stamm T, Heinecke A, Ehmer U. Speech performance in lingual orthodontic patients measured by sonagraphy and auditive analysis. Am J Orthod Dentofac Orthop. 2003;123(2):146-52.
7. Nassif CE, Cotrim-Ferreira A, Conti ACCF, Valarelli DP, de Almeida Cardoso M, de Almeida-Pedrin RR. Comparative study of root resorption of maxillary incisors in patients treated with lingual and buccal orthodontics. Angle Orthod. 2017;87(6):795-800.
8. Deguchi T, Terao F, Aonuma T, Kataoka T, Sugawara Y, Yamashiro T, et al. Outcome assessment of lingual and labial appliances compared with cephalometric analysis, peer assessment rating, and objective grading system in Angle Class II extraction cases. Angle Orthod. 2015;85(3):400-7.
9. Papageorgiou SN, Gölz L, Jäger A, Eliades T, Bourauel C. Lingual vs. labial fixed orthodontic appliances: systematic review and meta-analysis of treatment effects. Eur J Oral Sci. 2016;124(2):105-18.
10. Cline ME, Herman J, Shaw ER, Morton RD. Standardization of the visual analogue scale. Nursing Res. 1992;41(6):378-80.
11. Abdulmajed, A. Erişkin hastalarda direkt lingual ve labiyal ortodontik tedavi etkilerinin, hasta konforunun ve memnuniyetinin karşılaştırılarak incelenmesi. Doktora tezi, Hacettepe Üniversitesi, Ankara 2010.
12. Yeşil Şahin, E. İndirekt lingual ortodonti ve şeffaf plak teknikleriyle yapılan ortodontik tedavilerde hasta konforu, memnuniyeti, tedavi etkileri ve tedavi süresinin karşılaştırılması. Doktora tezi, Hacettepe Üniversitesi, Ankara 2015.
13. Feu D, de Oliveira BH, de Oliveira Almeida MA, Kiyak HA, Miguel JAM. Oral health-related quality of life and orthodontic treatment seeking. Am J Orthod Dentofac Orthop. 2010;138(2):152-9.
14. Hardwick LJ, Sayers MS, Newton JT. Patient's expectations of lingual orthodontic treatment: a qualitative study. J Orthod. 2017;44(1):21-7.
15. Chow J, Cioffi I. Pain and orthodontic patient compliance: a clinical perspective. Seminars in Orthod. 2018;24(2):242-7.
16. Billaiya P, Amin V, Begum M. Assessment of efficacy (Time taken during stage I and pain perception) of customized lingual orthodontic system. Int J App Dent Sci. 2019;5(3):234-9.
17. Tecco S, D'Attilio M, Tetè S, Festa F. Prevalence and type of pain during conventional and self-ligating orthodontic treatment. Eur J Orthod. 2009;31(4):380-4.
18. Wu AK, McGrath C, Wong RW, Wiechmann D, M. Rabie AB. A comparison of pain experienced by patients treated with labial and lingual orthodontic appliances. Eur J Orthod. 2010;32(4):403-7.
19. Rai AK, Rozario JE, Ganeshkar SV. Comparison of speech performance in labial and lingual orthodontic patients: A prospective study. Dent Res J. 2014;11(6):663-75.
20. Khattab TZ, Farah H, Al-Sabbagh R, Hajeer MY, Haj-Hamed Y. Speech performance and oral impairments with lingual and labial orthodontic appliances in the first stage of fixed treatment: a randomized controlled trial. Angle Orthod. 2013;83(3):519-26.
21. Caniklioglu C, Öztürk Y. Patient discomfort: a comparison between lingual and labial fixed appliances. Angle Orthod. 2005;75(1):86-91.
22. Shalish M, Cooper-Kazaz R, Ivgi I, Canetti L, Tsur B, Bachar E, et al. Adult patients' adjustability to orthodontic appliances. Part I: a comparison between Labial, Lingual, and Invisalign™. Eur J Orthod. 2012;34(6):724-30.
23. Rakhshan H, Rakhshan V. Pain and discomfort perceived during the initial stage of active fixed orthodontic treatment. Saudi Dent J. 2015;27(2):81-7.

https://doi.org/10.58711/turkishjdentres.vi.1245419

24. Ali SJ, Sasanka LK, Ramanadhan V, Ganapathy D. Orthodontics and Smile Correction in Teenagers-A Survey. Indian J Forensic Med & Tox. 2020;14(4):5486-93.

25. Lee R, Hwang S, Lim H, Cha J-Y, Kim K-H, Chung CJ. Treatment satisfaction and its influencing factors among adult orthodontic patients. Am J Orthod Dentofac Orthop. 2018;153(6):808-17.

26. Wu A, McGrath C, Wong R. W. K., Wiechmann D., and Rabie A. B. M. Comparison of oral impacts experienced by patients treated with labial or customized lingual fixed orthodontic appliances. Am J Orthod Dentofac Orthop. 2011;139(6):784-90.