OPEN ACCESS

Orapuh Journal

REVIEW ARTICLE

Journal of Oral & Public Health

Oral health challenges and management strategies for patients undergoing orthodontic treatment

Falegbe, R. K.[1], & Adamu, V. E.[2, 3]

[1]*Dental Design Laboratory, Lagos, Nigeria*
[2]*Engelhardt School of Global Health & Bioethics, Euclid University (Pôle Universitaire Euclide)*
[3]*Department of Public Health, Unicaf University, Longacres, Lusaka, Zambia*

ARTICLE INFO

Received: *14 April 2022*
Accepted: *21 February 2023*
Published: *01 December 2024*

Keywords:
Orthodontic treatment, malocclusion, oral health conditions, orthodontic appliances, oral hygiene management

Peer-Review: *Externally peer-reviewed*

Correspondence to:
Mr Raphael K. Falegbe
kennyraph5@gmail.com

To cite:
Falegbe, R. K., & Adamu, V. E. (2024). Oral health challenges and management strategies for patients undergoing orthodontic treatment. *Orapuh Journal*, *5*(6), e1160
https://dx.doi.org/10.4314/orapj.v5i6.60

ISSN: *2644-3740*

Published by Orapuh, Inc. (info@orapuh.org)

Editor-in-Chief: Prof. V. E. Adamu
Orapuh, Inc., UMTG PMB 405, Serrekunda, The Gambia, editor@orapuh.org.

ABSTRACT

Orthodontic treatment is a complex medical procedure that involves a series of steps aimed at achieving a desired outcome over an extended period, utilizing various types of appliances to correct malocclusion. This review seeks to explore common oral health issues faced by patients undergoing orthodontic treatment and to recommend effective strategies for addressing these problems. To gather relevant information, we conducted a comprehensive literature search across several databases, including PubMed/Medline, Google Scholar, JSTOR, Medscape, Elsevier, ResearchGate, Academia, Intechopen, and Sagepub, retrieving over 120 papers. The inclusion criteria were papers published in English between 2017 and 2021 within the review's subject area. From this pool, 50 papers were selected and thoroughly examined to provide the information presented in this article. The review is structured around orthodontic treatment concepts, types of appliances used to correct malocclusion, and the associated oral health conditions in patients, along with their management strategies. In conclusion, maintaining a high standard of oral hygiene is crucial for all patients undergoing orthodontic treatment. Patients should be educated on proper daily oral hygiene practices and encouraged to attend regular dental check-ups and prophylactic treatments.

INTRODUCTION

Orthodontic treatment is a complicated medical technique that involves a series of steps aimed at reaching a desired result over a long period, considering the application of appliances in different forms or types for the correction of malocclusion. Orthodontic treatment of patients with malocclusion improves the appearance of the oral and maxillofacial area while also enhancing masticatory performance and function. The purpose of orthodontic treatment is to improve the arrangement of teeth to achieve normal occlusion. Occlusion is the interdigitation of the upper and lower jaw teeth in the oral cavity. It is

essentially an integrated action of the muscles of the jaw, temporomandibular joints, and teeth (Shetty et al., 2019). The misalignment of the upper or lower jaw teeth is described as malocclusion. In most instances, malocclusion and dentofacial deformity are caused not by pathological reactions but by developmental processes. The impact of physical appearance on psychosocial significance is affected by malocclusion, especially in adolescents and young adults (Zou et al., 2018; Ahmed et al., 2021).

The number of individuals with malocclusion and oral conditions necessitating orthodontic treatment has drastically increased. Malocclusion has several negative impacts on the well-being of individuals. A growing number of people seeking orthodontic treatment have oral conditions that infringe on oral health-related quality of life (OHRQoL) (Chen et al., 2018; Elyaskhil et al., 2021; Pereira et al., 2021; Zamora-Martínez et al., 2021). Malocclusion is one of the most common dental problems in adolescents and adults, with a prevalence rate ranging from 20% to 100% (Alvarado et al., 2017; Zou et al., 2018; Perrotta et al., 2019). Orthodontic treatment of patients with malocclusion improves the appearance of the oral and maxillofacial area while also enhancing masticatory performance and function (Bucci et al., 2019; Choi, 2020).

This review aims to study oral health conditions in patients using orthodontic treatment appliances.

SELECTED COMMON ORTHODONTIC PROBLEMS

Some of the factors necessitating the use of an orthodontic appliance include crossbite, open bite, overcrowding, and excessive spacing.

Crossbite

A crossbite is a type of malocclusion/misalignment of teeth that occurs when the maxilla and mandible have a negative transverse disparity in occlusion, with the lower tooth overlapping the upper tooth. It may affect a single tooth or a group of teeth anteriorly or posteriorly, bilaterally or unilaterally. Posterior crossbite is an improper buccal–lingual relationship between premolars and/or molars of the opposing arches in centric occlusion, with prevalence rates ranging from 7.5% to 22%. Anteriorly, it is also known as an underbite, where the lower front teeth overlap the upper anterior teeth (Leonardi et al., 2018; Alhammadi et al., 2018; Dzingle et al., 2020; Caroccia et al., 2021).

Open Bite

An open bite is a type of malocclusion characterised by the absence of overlap or contact between maxillary and mandibular anterior teeth while the posterior teeth are in centric occlusion. It is the most complicated type of malocclusion, requiring a more complex approach involving skeletal (abnormal facial growth), dental (tooth eruption impediment), and habitual factors, including thumb or pacifier sucking, tongue thrusting, and temporomandibular joint disorder (Bianchi et al., 2017; Tavares & Allgayer, 2019; Laudadio et al., 2021).

Overcrowding

This is the second most common form of malocclusion after open bite (Tran & Picheca, 2017). Dental crowding, also known as swarming, is characterised by an imbalance between the size of the teeth and the dimensions of the arch, leading to malocclusion (Das et al., 2017). Tooth crowding is a frequent condition affecting many children, teens, and adults, necessitating orthodontic treatment as it can lead to health concerns or low self-esteem. Even though misaligned teeth might represent the uniqueness of a person's smile, the decision to fix crooked teeth is a personal one. This is a form of disarrangement of multiple teeth in the oral cavity (Decusara et al., 2019).

Excessive Spacing

Teeth spacing is an oral condition characterised by gaps between several teeth in the oral cavity. When there are unnatural gaps between teeth, this is known as abnormal tooth spacing. Excessive space between teeth can arise from various causes, including unusually small teeth, missing teeth due to congenital abnormalities or injuries, gum tissue abnormalities, or protruded teeth (Majumder et al., 2018; Mohamed et al., 2021). Spaces between teeth can lead to various dental and oral problems, such as eating difficulties, gum overexposure, self-consciousness about facial appearance—especially when smiling—and health-related quality of life issues (Alamri et al., 2019; Almotairy & Almutairi, 2020).

https://dx.doi.org/10.4314/orapj.v5i6.60

CONCEPT OF ORTHODONTIC TREATMENT APPLIANCE

Orthodontic treatment requires a detailed understanding of craniofacial growth and development. It is a complex medical intervention that involves a series of steps aimed at achieving a desired outcome over an extended period (Tiro, 2017). A shallow understanding of the developmental processes and treatment of the jaw and teeth can make it difficult to comprehend the various disorders, which predominantly affect children and young people.

A knowledge-based approach involving orthodontic appliances helps create and/or transmit forces to individual teeth, groups of teeth, and/or maxillo-facial skeletal units. These forces facilitate changes to correct deviations from an arbitrary norm, aligning teeth or rectifying other irregularities. However, orthodontic devices can cause functional restrictions, discomfort, and pain (Kharalampos et al., 2020).

The primary goals of orthodontic treatment are to improve oral hygiene, achieve functional masticatory efficiency, ensure structural balance, enhance aesthetics, align dentition, and reduce or eliminate occlusal trauma (Rajan et al., 2017; Manoj et al., 2020). Discomfort caused by orthodontic appliances can impact patient compliance with treatment. Moreover, aesthetic concerns are one of the primary reasons for poor cooperation (Erum and Azhar, 2020).

In orthodontics today, several treatment phases address different patient needs:

1. **Preventive Orthodontics**
   This involves preserving the integrity of what is normal for the age through education and monitoring the growth and development of the dentition and craniofacial structures (Xhemnica and Rroço, 2022).
2. **Interceptive Orthodontics**
   This refers to early intervention to eradicate or lessen the severity of a developing malocclusion (Kravitz, 2019).
3. **Corrective Orthodontics**
   This is aimed at addressing fully developed malocclusions, often requiring more intensive interventions.
4. **Surgical Orthodontics**
   This combines surgical and orthodontic treatments to address severe skeletal issues, such as a cleft palate.

Orthodontic treatment contributes to the long-term health of teeth, gums, and jaws by applying strategic forces to achieve desired changes.

Common Orthodontic Appliances

Orthodontic appliances are devices used to correct and manage malocclusion and other oral health-related conditions. These appliances may be classified as fixed or removable, depending on their intended purpose and the requirements of the treatment plan.

Fixed Orthodontic Appliances

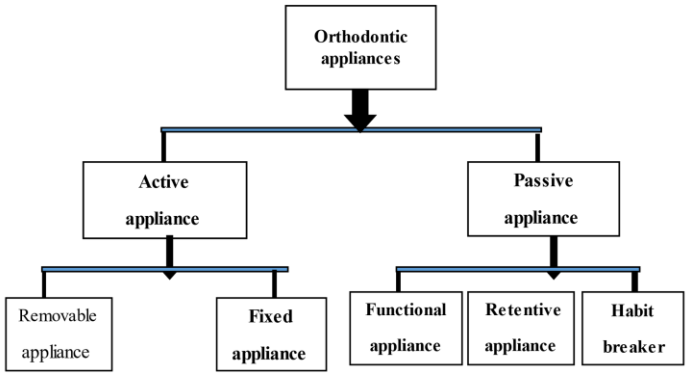
Fixed appliances are non-removable devices attached to teeth to provide continuous orthodontic force for correcting malocclusion. Brackets and bands are examples of fixed orthodontic appliances. Brackets are attached to the surface of each tooth, while bands encircle teeth entirely to provide additional anchorage and support. The wires that connect the brackets are tightened periodically to adjust alignment (Benson et al., 2020).

Removable Orthodontic Appliances

Removable orthodontic appliances are designed to be easily placed and removed by patients. These devices are typically used for minor orthodontic corrections or as a follow-up to fixed appliances. Examples include aligners, retainers, and expansion plates. Aligners, such as Invisalign, are a popular choice among adults due to their discreet appearance and convenience (Kravitz et al., 2019).

https://dx.doi.org/10.4314/orapj.v5i6.60

Figure 1:
Types of orthodontic treatment appliances



Authors' construct

COMMON ORAL CONDITIONS ASSOCIATED WITH ORTHODONTIC TREATMENT

Orthodontic treatment, while beneficial, may lead to various oral conditions or complications if not managed appropriately. These include periodontal issues, enamel demineralisation, and caries.

Periodontal Issues

Patients with orthodontic appliances are at a higher risk of developing periodontal diseases due to difficulty in maintaining oral hygiene. Gingivitis and periodontitis may result from plaque accumulation around orthodontic brackets and wires. Effective oral hygiene practices and regular professional cleanings can mitigate these risks (Sharma et al., 2020).

Enamel Demineralisation

Enamel demineralisation is a common side effect of orthodontic treatment. The areas surrounding brackets and bands are prone to plaque accumulation, which can lead to white spot lesions. These lesions are an early sign of enamel breakdown and may progress to caries if untreated. The use of fluoride treatments and meticulous oral hygiene can help prevent demineralisation (Ogaard, 2018).

Dental Caries

Orthodontic treatment can increase the risk of dental caries due to challenges in maintaining adequate oral hygiene. Plaque and food debris may become trapped around brackets, wires, and other components, creating an environment conducive to bacterial growth. Regular use of fluoride toothpaste and antibacterial mouth rinses is recommended to prevent caries during orthodontic treatment (Zeigler et al., 2018).

MANAGEMENT OF THE ORAL HEALTH PROBLEMS ASSOCIATED WITH THE USE OF ORTHODONTIC TREATMENT APPLIANCES

The management of malocclusion-related oral health issues is significantly dependent on the type of malocclusion being treated. The benefits of orthodontic therapy should always outweigh any potential negative consequences. To achieve this balance, it is essential to assess the oral health problems associated with orthodontic treatment (Hajrasi et al., 2020).

In fixed orthodontic treatments, components such as arch wires, headgears, and brackets can cause considerable damage, either during the active treatment phase or during debonding. For this reason, maintaining excellent oral hygiene is crucial before initiating any active orthodontic treatment. Patients must receive proper advice to mitigate potential risks. The success of orthodontic treatment also depends on the patient's personal motivation and cooperation in adhering to prescribed guidelines for appliance use (Peeva, 2017).

For patients using fixed and removable appliances, regular oral hygiene assessments are necessary to support effective treatment planning. The following suggestions are vital for managing oral health during orthodontic therapy:

- **Implementation of Psychological and Educational Strategies**
  Assess and use psychological and educational approaches to enhance patient compliance. Provide recommendations and follow-up on strategic cleaning techniques to ensure sustained dental hygiene.
- **Dietary and Hygiene Guidance for Children**
  Parents should encourage their children to limit their exposure to harmful diets, such as sugary snacks, and to floss their teeth thoroughly, especially before bedtime.
- **Regular Dental Visits**
  Encourage regular dental clinic visits to ensure

adequate plaque removal and monitor oral hygiene progress.

By addressing these considerations, orthodontic treatment can effectively manage malocclusions while minimising oral health issues.

CONCLUSION

Orthodontic treatment plays a critical role in correcting malocclusion and enhancing oral health-related quality of life. However, it is not without potential complications. Awareness of common orthodontic problems, appliances, and associated oral conditions is essential for clinicians and patients to ensure optimal outcomes. Adherence to oral hygiene practices, regular dental visits, and patient education are crucial in mitigating the risks associated with orthodontic appliances.

Acknowledgments: We appreciate the sources that we have cited in this review.

Ethics Approval: Nil required.

Conflicts of Interest: None declared.

ORCID iDs:

Falegbe, R. K.[1]: https://orcid.org/0000-0002-5238-96150

Adamu, V. E.[2, 3]: https://orcid.org/0000-0003-3352-0021

REFERENCES

Ahmed, A., Yousaf, U., Shah, M. U., Amina, G., Ikram, M., Naeem, S., & Siddique, S. N. (2021). Psychological impact of malocclusion among teenagers. *Pakistan Journal of Medical and Health Science*, *15*(12), 2021–4015. https://doi.org/10.53350/pjmhs2115124015

Alamri, A. M., Alshammery, H. M., Almughamis, M. A., Alissa, A. S., Almadhi, W. H., Alsharif, A. M., Sroji, D. T., & Alqarni, M. A. (2019). Dental recession aetiology, classification, and management. *Archives of Pharmacy Practice*, *10*(2), 28–31.

Alhammadi, M. S., Halboub, E., Fayed, M. S., Lab, A., & Elsaadi, C. (2018). Global distribution of malocclusion traits: A systematic review. *Dental Press Journal of Orthodontics*, *23*(6), 40.

Almotairy, N., & Almutairi, F. (2020). A nation-wide prevalence of malocclusion traits in Saudi Arabia: A systematic review. *Journal of International Society of Preventive & Community Dentistry*, *12*(1), 1–11. https://doi.org/10.4103/jispcd.JISPCD_251_21

Alqahtan, I. M., Azizkhan, R. A., Alyawer, L. T., Alanazi, S. S., Alzahrani, R. A., Alhazmi, L. S., Bsher, F. F., Zahran, L. M., Aljahdali, R. A., Alqwizany, R. R., & Tayeb, R. K. (2020). An overview of diagnosis and management of malocclusion: Literature review. *Annals of Dental*, *8*(4).

Alvarado, K., Lopez, L., Hanke, R., Picon, F., & Rivas-Tumanyan, S. (2017). Prevalence of malocclusion and distribution of occlusal characteristics in 13–18-year-old adolescents attending selected schools in the municipality of San Juan, PR (2013–2013). *PR Health Science Journal*, *36*(2), 61–66.

Amin, E., & Bangash, A. A. (2020). Orthodontic appliance and patient perceived problems. *Armed Forces Medical Journal*, *70*(1), 101–105.

Anuwongnukroh, N., Dechkunakorn, S., & Kanpiputana, R. (2017). Oral hygiene behavior during fixed orthodontic treatment. *Dentistry*, *7*, 457. https://doi.org/10.4172/2161-1122.1000457

Atanasova, S., Kovacevska, V., Nashkova, S., Toneva, V., Zlataanovska, K., & Longurova, N. (2018). Side effect of orthodontic treatment knowledge. *International Journal of Scientific Papers*.

Bianchi, J., Pinto, A. D. S., Ignácio, J., Ryan, D. P., & Gonçalves, J. R. (2017). Effect of temporomandibular joint articular disc repositioning on anterior open-bite malocclusion: An orthodontic-surgical approach. *American Journal of Orthodontics and Dentofacial Orthopedics*, *152*(6), 848–858.

Bittencourt, J. M., Martins, L. P., Bendo, C. B., Vale, M. P., & Paiva, S. M. (2017). Negative effect of malocclusion on the emotional and social well-being of Brazilian adolescents: A population-based study. *European Journal of Orthodontics*, *39*, 628–633. https://doi.org/10.1093/ejo/cjx020

Bucci, R., Koutris, M., Lobbezoo, F., & Michelotti, A. (2019). Occlusal sensitivity in individuals with different frequencies of oral parafunction. *Journal of Prosthetics Dentistry*.

Bukhari, A., Kennedy, D., Hannam, A., Aleksejunien, E. J., & Yen, E. (2018). Dimensional changes in the palate associated with slow maxillary expansion for early treatment of posterior crossbite. *Angle Orthodontist*, *88*, 390–396.

Caroccia, F., Moscagiuri, F., Falconio, L., Festa, F., & D'Attilio, M. (2021). Early orthodontic treatment of unilateral posterior crossbite: A systematic review. *Journal of Clinical Medicine*, *10*(1), 33. https://doi.org/10.3390/jcm10010033

Chen, J., Wan, J., & You, W. (2018). Speech and orthodontic appliances: A systematic literature review. *European Journal of Orthodontics*, *40*(1), 29–36. https://doi.org/10.1093/ejo/cjx023

Choi, Y. Y. (2020). Relationship between orthodontic treatment and dental caries: Results from a national survey. *International Dental Journal*, *70*(1), 38–44. https://doi.org/10.1111/idj.12515

Das, P., Y., Dkhar, W., & Pradhan, A. (2017). An evaluation of dental crowding in relation to the mesiodistal crown widths and arch dimensions in Southern Indian population. *Journal of Clinical and Diagnostic Research*, *11*(9). https://doi.org/10.7860/JCDR/2017/29642.10554

Decurasa, M., Cornea, D., Sincar, D., & Ilie, M. (2019). Dental crowding-clinical and therapeutic implications. *Romanian Journal of Oral Rehabilitation*, *11*, 4.

Elyaskhil, M., Shafai, N. A. A., & Mokhtar, N. (2021). Effect of malocclusion severity on oral health-related quality of life in Malay adolescents. *Health and Quality of Life Outcomes*, *19*, 71. https://doi.org/10.1186/s12955-021-01710-2

Enerbäck, H., Möller, M., Nylén, C., Ödman-Bresin, C., Östman, R. I., & Westerlund, A. (2019). Effects of orthodontic treatment and different fluoride regimens on numbers of cariogenic bacteria and caries risk: A randomized controlled trial. *European Journal of Orthodontics*, *41*(1), 59–66. https://doi.org/10.1093/ejo/cjy025

Erum, A., & Azhar, A. B. (2020). Removable orthodontic appliance and patient-perceived problems. *Pak Armed Forces Medical Journal, 70*(1), 101–105.

Hajrasi, M. K., Al-Fraidi, A. A., Hatrom, A. A., & Hassan, A. H. (2020). Non-extraction management of severely malaligned and constricted upper arch. *Case Reports in Dentistry.* https://doi.org/10.1155/2020/8836061

Kettle, J. E., Hyde, A. C., Frawley, T., Granger, C., Longstaff, S. J., & Benson, P. E. (2020). Managing orthodontic appliances in everyday life: A qualitative study of young people's experiences with removable functional appliances, fixed appliances, and retainers. *Journal of Orthodontics, 47*(1), 47–54. https://doi.org/10.1177/1465312519899671

Kharalampos, M., Put, V. A., Tarasenko, S. V., & Reshetov, I. V. (2020). Comprehensive patient rehabilitation while performing immediate dental implant placement with the use of information-wave therapy: Literature overview. *Journal of Advance Pharmaceutical Educational Research, 10*(2), 11–14.

Kravitz, N. D. (2019). Interceptive orthodontics with resin turbos for pseudo-Class III malocclusions. *Case Reports in Dentistry, 20*(19), 6. https://doi.org/10.1155/2019/1909063

Kudagi, V. S., Shvakuma, S., & Bhagyalashm, A. (2021). Adverse effects of orthodontic treatment: A review. *International Journal of Applied Dental Science, 7*(4), 304–305.

Laudadio, C., Inchingolo, A. D., Malcangi, G., Limongelli, L., Marinelli, G., Coloccia, G., Montenegro, V., Patano, A., Inchingolo, F., & Bordea, I. R. (2021). Management of anterior open-bite in the deciduous, mixed, and permanent dentition stages: A descriptive review. *Journal of Biology Regulation and Homeostasis Agents, 35*, 271–281.

Leonardi, R., Giudice, A. L., Rugeri, M., Muraglie, S., Cordasco, G., & Barbato, E. (2018). Three-dimensional evaluation on digital casts of maxillary palatal size and morphology in patients with functional posterior crossbite. *European Journal of Orthodontics, 40*(5), 556–562. https://doi.org/10.1093/ejo/cjx103

Lucchese, A., Bonini, C., Noviello, M., Lupo Stanghellini, M. T., Greco, R., Peccatori, J., Biella, A., Tassi, E., Beretta, V., & Ciceri, F. (2021). The effect of removable orthodontic appliances on oral microbiota: A systematic review. *Applied Sciences, 11*, 2881. https://doi.org/10.3390/app11062881

Majumder, A., Chowdhury, S., Mukherjee, S., & Giri, T. K. (2018). Management of spacing in maxillary anterior teeth by minimally invasive techniques using laminate: A case report. *International Journal of Contemporary Medical Research, 4*, 1–3. https://doi.org/10.21276/ijcmr.2018.5.4.5

Manoj, P., Nikhilmitha, T. A., & Padmavati, R. (2020). Removable orthodontic appliance – Review article. *European Journal of Molecular & Clinical Medicine, 7*(2), 6423.

Mohamed, N., Al-Kadhim, A. H. A., & Wan Hussin, W. H. I. (2021). Closing the diastema and teeth spacing using direct composite resin build-up. *Malaysian Journal of Science Health & Technology, 7*(194), 22–25. https://doi.org/10.33102/mjosht.v7iSpecial

Naveen, K., Dhanraj, G., & Sherlyn, S. P. (2018). Oral hygiene methods followed by patients with malocclusion. *Journal of Pharmacy Research, 12*(2).

Omale, J. J., Hussain, B. M., Nwosu, C. P., Olofin, O. A., Okoli, S. C., & Ohadoma, A. N. (2021). Significance of oral health education in maintaining oral health. *Oral and Public Health Journal, 2*(1), 809.

Pan, S., Liu, Y., Zhang, L., Li, S., Zhang, Y., Liu, J., Wang, C., & Xiao, S. (2017). Profiling of subgingival plaque biofilm microbiota in adolescents after completion of orthodontic therapy. *PLoS ONE, 12*(2), e0171550. https://doi.org/10.1371/journal.pone.0171550

Patel, M., Henriques, J., Freitas, K., Almeida, R., & Janson, G. (2020). Stability of Class II treatment with Pendulum and Jones Jig followed by fixed appliances. *Orthodontics & Craniofacial Research.* https://doi.org/10.1111/ocr.12447

Peeva, Y. B. (2017). Personal recommendations and tips to orthodontic patients: A systematic review. *Journal of Oral Medicine, 1.*

Pereira, D., Machado, V., Botelho, J., Proença, L., Rua, J., Lemos, C., Mendes, J. J., & Delgado, A. S. (2021). Impact of malocclusion, tooth loss, and oral hygiene habits on quality of life in orthodontic patients: A cross-sectional study. *International Journal of Environmental Research and Public Health, 18*, 7145. https://doi.org/10.3390/ijerph18137145

Perrotta, S., Bucci, R., Simeon, V., Martina, S., Michelotti, A., & Valletta, R. (2019). Prevalence of malocclusion, oral parafunctions, and temporomandibular disorder-pain in Italian schoolchildren: An epidemiological study. *Journal of Oral Rehabilitation, 46*, 611–616.

Rajan, K. M., Govind, R. S., & Umal, H. D. (2017). Effects of fixed orthodontic treatment on gingival health: An observational study. *International Journal of Applied Dental Sciences, 3*(3), 156–161.

Sandra, P., Natalia, W., Egle, S., & Gintare, Z. (2019). Changes in oral hygiene habits among adolescents receiving orthodontic treatment. *Dental Journal, 7*(96). https://doi.org/10.3390/dj7040096

Shetty, G., Poovani, S., Al-Sulaihi, K., & Bukkapatnam, S. (2019). Fundamentals of occlusion: Overview. *International Journal of Science and Research, 7*, 426. https://doi.org/10.31276/ijcsr

Tavares, C. A. E., & Allgayer, S. (2019). Open bite in adult patients. *Dental Press Journal of Orthodontics, 24*(5), 69–78. https://doi.org/10.1590/2177-6709.24.5.069-078.bbo

Tiro, A. (2017). Orthodontic treatment-related risks and complications: Part 1 dental complications. *South European Journal of Orthodontic Dentofacial Research, 4*(2), 43–47.

Tran, K., & Picheca, L. (2017). Orthodontic treatment for the management of pain or impacted teeth in patients with malocclusion: A review of clinical effectiveness and guidelines. *CADTH Rapid Response Report: Summary With Critical Appraisal.*

Wang, Q., Ma, J. B., Wang, B., Zhang, X., Yin, Y. L., & Bai, H. (2019). Alterations of the oral microbiome in patients treated with the Invisalign system or with fixed appliances. *American Journal of Orthodontics and Dentofacial Orthopedics, 156*, 633–640.

Xhemnica, R., & Rroço, M. (2022). Preventive and interceptive orthodontic treatment. *European Journal of Medicine and Natural Sciences, 5*(1), 26–31.

Zamora-Martínez, N., Paredes-Gallardo, V., García-Sanz, V., Gandía-Franco, J. L., & Tarazona-Álvarez, B. (2021). Comparative study of oral health-related quality of life (OHRQL) between different types of orthodontic treatment. *Medicina, 7*(7), 683. https://doi.org/10.3390/medicina57070683

Zou, J., Meng, N., Law, C. S., Rao, Y., & Zhou, X. (2018). Common dental diseases in children and

malocclusion. *International Journal of Science, 10*(1), 7. https://doi.org/10.1038/S41368-018-00132