# Management of Dento-Maxillary Disharmony in Angle Class I Malocclusion with Anterior Crowding, Midline Shifting, and Deep Bite: A Case Report

Staclyn Ongelina and Ida Bagus Narmada

*Department of Orthodontic, Faculty of Dental Medicine, Universitas Airlangga, Surabaya, Indonesia*

## ABSTRACT

Dento-maxillary disharmony is characterized as disproportion between tooth size and dental arch. This case report describes the treatment progress of a patient with dento-maxillary disharmony with Class I malocclusion using fixed orthodontic appliances. The patient is a 19-year-old female who came with chief complaint of crowding and ectopic upper canines. Correction of crowding and deep bite was achieved by fixed appliance with extraction. In Class I malocclusion, severity, etiology, and type of disharmony guide the treatment plan for optimal results.

*Key Words: Angle class I malocclusion, dento-maxillary disharmony, orthodontic treatment*

## INTRODUCTION

Worldwide, in both mixed and permanent dentitions, Angle Class I malocclusion is more prevalent than Class II, and the least prevalent is Class III.[1] Class I malocclusion, as defined by Angle, incorporates a normal inter-arch relationship, and exists when there is a harmonious relationship of the underlying skeletal structures;the malocclusion component is restricted to dental misalignments only,[2] usually characterized by a normal molar relationship, but with some degree of overcrowding and misalignment of teeth.[3] One of the malocclusion's etiologies in this case is dento-maxillary disharmony, which is a disproportion between the size or the mesiodistal diameter of the teeth and the perimeter of the corresponding alveolar arches. An individual can inherit big teeth from one of his parents and small jaws from the other, and vice versa.[4] One of the most commonly encountered malocclusions in this group are cases involving crowding in the maxillary and mandibular arches.[2] Crowding is the most common complication in adults, and is found in around 24% of females and 14% of males.[5] As the anterior teeth are visible during a smile, in crowding of the front teeth, aesthetic alignment of this area is very important in every orthodontic treatment. Any misplacement in this area has an impact on the patient's well-being and quality of life; for this reason, many patients pursue orthodontic treatment.[4,5] Dento-maxillary disharmony presents many clinical signs that allow early diagnosis. Furthermore, this condition causes retention of food debris and development of plaque, and difficulty in removing them by self-cleaning or artificial cleaning presents a risk factor for the presence of septic inflammation. Thus it is essential to dento-maxillary disharmony.[4,6] The type of disharmony and its severity guide

*Paper presented at the Joint Scientific Meeting in Special Care Dentistry, July 5, 2019, Amerta Room, 4th Floor, main campus of Universitas Airlangga, Surabaya, Indonesia.*

Corresponding author: Ida Bagus Narmada
Department of Orthdontic
Faculty of Dental Medicine
Universitas Airlangga
Jl. Mayjen. Prof. Dr. Moestopo No. 47 Surabaya 60132 – Indonesia
Email: dr_narmada@yahoo.com

the therapeutic choice: management of the space, expansion of the arches, or proceeding with planned extractions.[4]

Treatment for Class I malocclusion is generally by using fixed appliances.[2,3] The choice of the appliance and the need for extraction is to be assessed on each individual case. Severe crowding cases may require the extraction of all first or second pre-molars depending upon the space and anchorage requirements. Advantages of fixed orthodontic appliances include the following: precise tooth control is possible; multiple tooth movement in which the tooth can be moved in all three planes of space; and better patient cooperation compared to removable appliance.[2] Due to the prevalence of Class I malocclusion with crowding, which gives unfavorable aesthetic and health impacts, and considering the benefits of using fixed orthodontic appliances, this paper is presented to describe the orthodontic treatment's progress of a case of dento-maxillary disharmony in Class I Angle malocclusion with extraction and fixed orthodontic appliances.

## CASE REPORT

A 19-year-old female came to the Universitas Airlangga Dental Hospital with chief complaints of crowding in the upper and lower arches and ectopic of upper canines; she had never done orthodontic consultation before, and wanted to be treated to improve the appearance of her teeth.

Extra oral examination (Figure 1) showed a convex face profile, medium face type, mesocephalic head shape, and competent lips. She also had normal speech function, and no bad habits.

Intra oral photographs (Figure 2) revealed normal oral mucosa, tongue and palate, with moderate caries frequency; moderately good oral hygiene was also noted. Findings included caries at tooth numbers 11 and 21; gangrene radix at 36 and 44; maxillary midline deviation of 0.5 mm to the right, and mandibular midline deviation of 2 mm to the right; crowding in the anterior maxilla and mandible

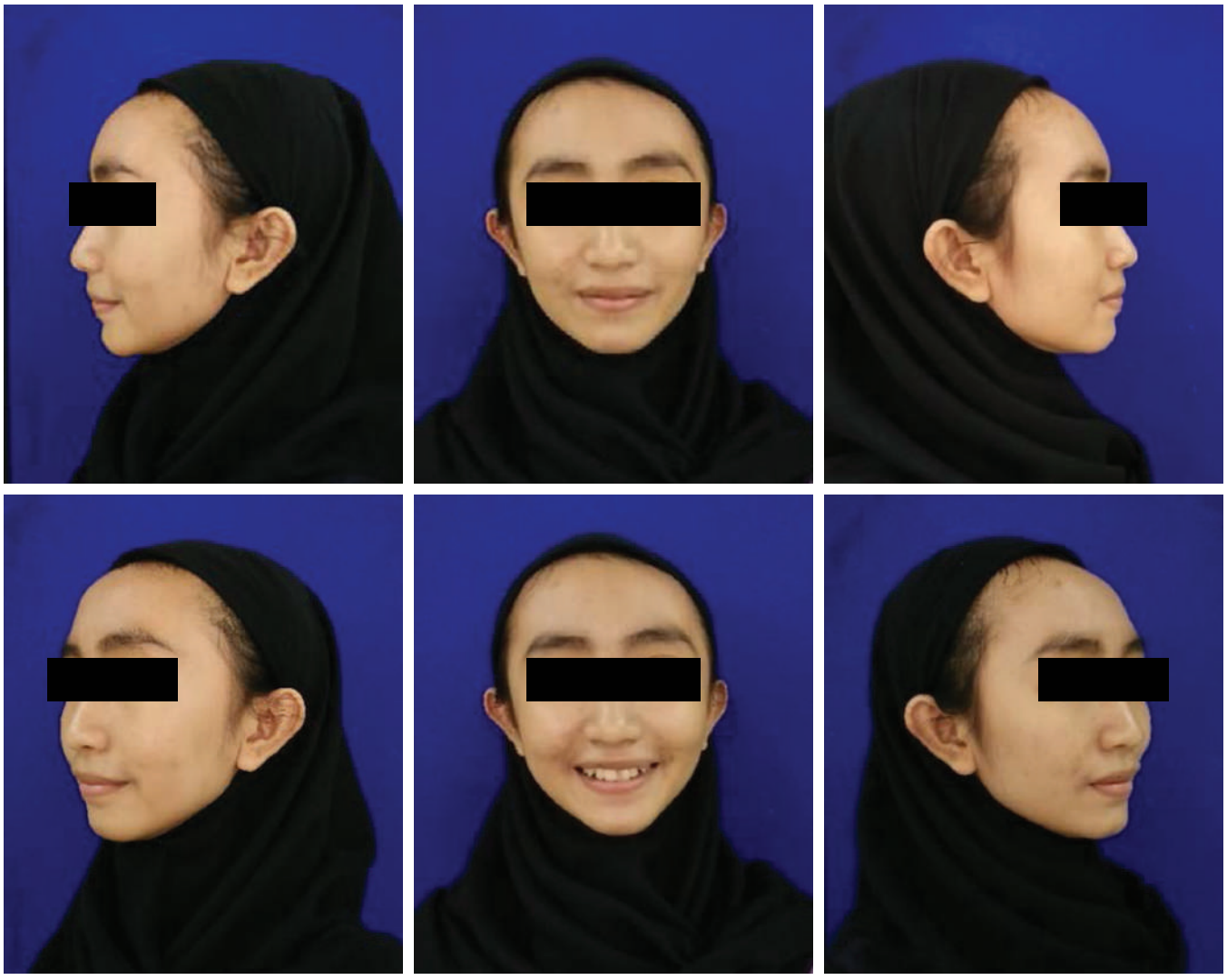

**Figure 1.** Patient's extraoral photographs.

**Figure 2.** Patient's intraoral photographs.

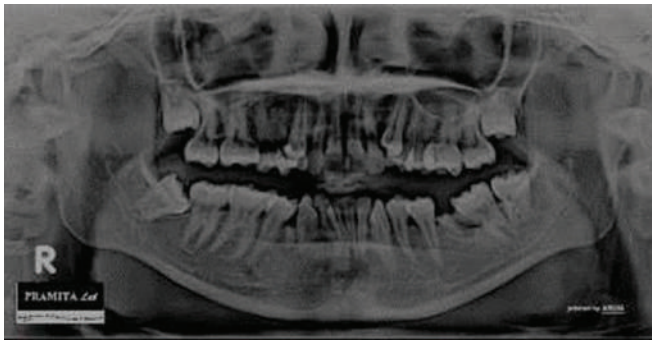


**Figure 3.** Patient's orthopantomogram.


**Figure 4.** Patient's cephalogram.

region; supraposition on mandible in 42-41-31-32 region; ectopic position of 13 and 23. Furthermore, sagittally, the relation of the right canine was edge to edge, and there was neutroclussion of the left canine. There was neutroclussion of the right molar, but the left molar had no relational problem. Overjet of 2 mm, and overbite of 5 mm were also noted. Dental casts analysis indicated discrepancy in the upper arch of -11.5 mm; discrepancy in the lower arch of 3.5 mm, and curve of spee of 3.5 mm positive.

Patient's orthopantomogram (Figure 3) showed residual roots of teeth 36 and 44. Teeth 18 and 28 were distally and superiorly located from 17 and 27, respectively. There was also impaction of tooth 48.

Cephalometric analysis (Figure 4) indicated the patient had a convex profile with ∠NA-Apog value 10º and ∠FH-Npog 71,5º. The maxilla and mandible relation to the cranium base showed skeletal Class I relationship with ∠ANB 4º, also with appraisal of 0 mm. Dental inclination of maxillary incisor tended to be upright with the value of ∠I RA-NA 19º, and mandibular incisors were protrusive with ∠I RB-NB 32º, ∠IMPA 102º, and ∠FMIA 40º (Table 1). Soft tissue analysis showed convex profile with ∠GSn-SnPog' 17º, ∠naso labial 96º; this was also shown in the Rickett's and Steiner's lip analysis of the upper and lower lips (Table 1).

**Table 1.** Cephalometric analysis

| Variable | Normal | Patient's Measurements |
|---|---|---|
| ∠NA-Apog | 6,1° | 10° |
| ∠FH-Npog | 84,8° | 71,5° |
| ∠SNA | 84,3° | 78° |
| ∠SNB | 81,4° | 74° |
| ∠ANB | 3° | 4° |
| ∠I RA-NA | 26° | 19° |
| ∠I RB-NB | 29° | 32° |
| AO-BO | 0 mm | 0 mm |
| ∠IMPA | 90° | 102° |
| ∠FMA | 25° | 38° |
| ∠FMIA | 65° | 40° |
| ∠GSn-SnPog' | 11±3° | 17° |
| ∠Naso Labial | 110-120° | 96° |
| Rickett's Lip Analysis | – Upper lip: 2-3 mm behind E line.<br>– Upper lip: 1-2 mm behind E line. | – Upper lip: 0 mm right on E line.<br>– Upper lip: 0 mm right on E line. |
| Steiner's Lip Analysis | – Lip located behind S line: too flat<br>– Lip located beyond S line: too protrusive | – Upper lip: 3 mm beyond S line.<br>– Upper lip: 1 mm beyond S line |

## Diagnosis

The patient was diagnosed to have Angle Class I malocclusion with anterior crowding, midline shifting, and deep bite.

## Etiology

The Angle Class I malocclusion in this case was mainly due to dento-maxillary disharmony factors, where the size of the teeth was normal but the arch was small. Local factors that affected the patient's condition were gangrene in the radix of teeth 36 and 44.

## Treatment objectives

Treatment objectives were to correct the maxillary and mandibular crowding, the midline shifting on upper and lower arch, and the deep bite, and to achieve a Class I relationship with ideal arch form, overjet, and overbite.

## Treatment plan

According to the information gathered from both clinical examination and diagnostic records, it was planned to relieve the maxillary and mandibular crowding, midline shifting, and deep bite with fixed appliance. The treatment plan included extraction of the gangrenous tooth in the mandible and the the first premolars in the maxilla, odontectomy of the right third molar, and periodontal treatment. This was to be followed by alignment of the upper and lower teeth with orthodontic preadjusted edgewise brackets appliances, and to be concluded by removable of the retainer on both arches.

## Treatment progress

Informed consent was taken from the patient and the medical record was updated as needed.

Prior to the extractions, scaling was done and an impression was taken for the study model. In 3 months, extraction of teeth 36 and 44 with gangrenous radix was carried out, followed by extraction of teeth 14 and 24, and odontectomy of tooth 48. After the preliminary treatment, molar bands were cemented first and second molars of the maxilla, and the mandible's right first molar and second molars; buccal tubes using 0.022" slots for the left third molar were also applied. A 0.022" slots MBT (McLaughlin, Bennett, and Trevisi) prescription preadjusted edgewise appliance (American Orthodontic) was then bonded in both arches, bypassing teeth 13, 23 and 42. Leveling and aligning was started with with Nickel Titanium (NiTi) round 0.012, followed by NiTi round 0.014 for the upper and lower arches. Two months after the bracket placement, teeth 13 and 42 were involved in the application of archwire for leveling using super-elastic wire NiTi round 0.012; laceback was then applied on 23 to strengthen the retraction (Figure 5). Leveling and aligning continued with NiTi round 0.016 for both arches, bypassing 23. Then, using the piggyback technique on the maxilla, wire size was increased to Stainless-Steel (SS) recta 0.016 x 0.016 on the upper arch, and NiTi round 0.012 for leveling and aligning of tooth 23 (Figure 6). SS recta 0.016 x 0.016 were inserted to the lower arch with a loop made in the region between teeth 35 and 37, for uprighting tooth 37. The next stage was retraction of maxillary canine 13 and 23, and space closing in the lower arch. After around 17 months of treatment (Figures 7 and 8), the crowding on the upper and lower arches and the deep bite were corrected. In the middle of orthodontic treatment, extraction of 18 and 28 that erupted was carried out. Elastic class II on the left arch was applied to help correct the interdigitation and midline shifting.

# DISCUSSION

In this paper we discussed the case of a 19-year-old female who came to the Universitas Airlangga Dental Hospital with chief complaints of crowding in upper and lower arches and ectopic upper canines. Due to increased consciousness regarding facial appearance, seeking treatment to improve aesthetic appearance has become very common practice these days. Since majority of orthodontic abnormalities are asymptomatic, consultations are made in association with aesthetic problems rather than functional problems.[4,5] As the anterior teeth are revealed during a smile, aesthetic alignment of anterior teeth is very important in every orthodontic treatment.[5] Any misplacement or irregularity in this area has an impact on the patient's well-

**Figure 5.** Patient's intraoral photograph (lacebacks).

**Figure 6.** Patient's intraoral photograph (piggyback technique).

being and quality of life and this is the reason why most patients pursue orthodontic treatment.[4,5] Malocclusion with crowding is also a risk factor for the presence of septic inflammation; due to the disparity between mesial-distal sizes of permanent teeth and corresponding alveolar arches perimeter, various dental malposition occur, localized mainly in incisor-canine region, which causes retention of food debris and plaque, and difficulty in removing them by self-cleaning or artificial cleaning.[6]

Early diagnosis and successful treatment of malocclusions can have both short-term and long-term benefits by achieving the goals of occlusal harmony and function, as well as dento-facial aesthetics. Thus, dentists have the responsibility to recognize, diagnose and manage or refer abnormalities of dentition, depending on the complexity of the problem and the training, knowledge and experience of the clinician.[4] Choice of treatment for crowding depends on age, affected jaw and the severity of crowding.[5] In this case the patient had severe crowding, midline shifting, and deep bite, caused by dento-maxillary disharmony. It is important to decide how we manage each case of crowding, to achieve best result**.** The problem may be solved by extracting teeth in both arches or without extraction. The degree of the malocclusion and the number of teeth extracted affect the treatment duration.[5]

Dento-maxillary disharmony presents with many clinical signs that allow for early diagnosis. The type of disharmony, its severity, and its etiology guide the therapeutic choice from among the management of the space, the expansion of the arches, or the realization of planned extractions.[4] There are 2 suggested treatment protocols for Class I malocclusion: non-extraction or extraction. In non-extraction, space is gained with stripping, expansion, derotation, uprighting, or distalisation. On the other hand, extraction is usually done with the upper/lower first premolar, upper/lower second premolar, or with asymmetric extraction or single tooth extraction.[7]

In this case, there was severe crowding where the deficiency discrepancy was -11.5 mm in the maxilla, and space could be provided by extraction of 14 and 24 permanent teeth. Extraction is one of the most common methods of gaining space in the arch.[2] Based on arch length-tooth material discrepancy, guidelines for extraction in Class I crowding of less than 4 mm arch length discrepancy, extraction is rarely indicated; for 5-9 mm arch length discrepancy, non extraction or extraction is possible depending on the details of the therapy; for 10 mm or more arch length discrepancy, extraction is almost always required,[2,8] therefore, in this case, tooth extraction in the maxilla was carried out. Extraction of 14 and 24 was carried out; the first premolar is the tooth most commonly extracted as part of orthodontic therapy especially for the relief of crowding, because it is positioned near the center of each quadrant of the arch and is therefore near the site of crowding, thus, the space gained by the extraction can be utilized for correction both in the anterior and posterior region. Extraction of the first molar is least likely to upset molar occlusion and is the best alternative to maintain vertical dimension. The contact between the canine and second premolar is satisfactory.[2]

In this case, extraction of the gangrenous radix and odontectomy of tooth 48 was carried out in the mandible. There were inadequate remaining tooth tissue and periapical lesions of 36 and 44 on orthopantomogram examination, so extraction of the remaining roots of teeth 36 and 44 was performed. Decision to carry out odontectomy of 48 was due to third molar's position which was close to the root of tooth 47; mesioversion and partial eruption could occur clinically. We indicated odontectomy to prevent pathological processes, such as root resorption or caries in the second molars, pericoronitis, periodontal defects

**Figure 7.** Patient's extraoral photographs (during treatment).

**Figure 8.** Patient's intraoral photographs (during treatment).

in the distal surface of second molars, odontogenic cysts, and dental crowding. A prospective study showed that extraction of third molars is done mainly to prevent future problems or because a third molar had an unfavorable orientation or was unlikely to erupt.[9] Mandibular third molars need to create space in the dental arch in order to erupt, causing crowding of the anterior teeth.[10] There are hundreds of reports in the literature on jaw fracture after third molars surgeries, predominantly occurring in patients who are older than 25 years. Thus, it seems reasonable to believe that postponing the extraction of third molars can increase the risk of mandibular fracture.[9] On the other hand, tooth 38 was maintained because third molars can be used to replace a first or second molar previously extracted in this case tooth 36 was indicated to be extracted. Initially, teeth 18 and 28 were not extracted, because for orthodontic patients, the decision whether or not to remove third molars could be postponed until the end of orthodontic treatment, except for situations in which the removal of a third molar is mandatory since the beginning of treatment.[9]

After preliminary treatment, molar bands were cemented to the maxillary first and second molars, and also for the mandibular right first molar, second molars, and buccal tubes. This treatment used molar bands because, molars are a very active part of the mouth which can put a lot of stress on the brackets. Molar bands increase the stability of the brackets so they are less likely to break;[11] except for molars with high gingival margin that does not allow the molar bands to be inserted, and thus buccal tubes could be used.

In the case, the patient used fixed orthodontic appliances. Fixed orthodontic appliances are indicated whenever multiple tooth movement is required, e.g. intrusion, derotation, controlled space closure at extraction sites, bodily movement, extrusion or torque control, which were needed by this patient.[2] Using 0.022" slots MBT bracket system which is a third-generation preadjusted edgewise appliance that introduces a range of improvements and specification changes to overcome the clinical shortcomings of earlier preadjusted edgewise bracket systems.[12] Present study showed that MBT appliance is effective in ensuring a successful treatment result, though individual adjustments may be necessary for optimal tooth positioning at the end of the treatment, as with any other preadjusted appliance.[12] Using 0.022" slots to perform more freedom of movement of initial aligning arch wires in the relatively larger slot is practiced; likewisenewer orthodontic alloys can be used in 0.022" slots with minimum patient discomfort and optimum clearance for sliding is obtained.[13,14]

Leveling and aligning begins with NiTi round archwire; NiTi was used at the beginning because the wire bypasses 13 and 23. Superelastic NiTi was used 2 months later, when tooth 13 which was very ectopic in position was included in the wire. NiTi wires could attend to the requirements for an archwire performance, which include low elastic modulus, high flexibility, minimal plastic deformation, resistance to fatigue, strength, good corrosion resistance, biocompatibility and production of constant small forces over a wide range of displacements.[15,16] Shape memory is one of the remarkable properties of the NiTi alloys.[16] The advantages of these wires include: fewer archwires are required to achieve the desired changes during orthodontic treatments, less chair side time, and less patient discomfort.[15,16] Their poor formability makes them best suited for the pre-adjusted appliance.[16]

In patients with severe crowding of anterior teeth, it is necessary to retract the canines into premolar extraction sites to gain enough space to align the incisors.[8] The common canine retraction methods use the active ligatures (active lace back) or NiTi coil spring. The results of the present study showed that canine retraction by laceback is associated with lesser tipping and rotation of the canine and lesser tipping of the molar compared to retraction by coil spring.[17] Laceback ligatures are figure-of-eight stainless steel ligatures that are tied lightly between the canine and the most distally banded molar. They are thought to control the arch length between the molar and canine as canine bracket prescription of angulation is being expressed, thus preventing the incisors from proclining (flaring/moving forwards) during the levelling and aligning phase. Therefore lacebacks were applied on tooth23, to maintain or retract the position of the canine crown and encourage the canine root to tip distally as the tip in the bracket is expressed thus leaving the position of the incisors undisturbed.[18] After lacebacks were used at the beginning of treatment to help retraction, the treatment was continued by using the piggyback technique in tooth 23. It is a technique where a segment of NiTi wire is piggybacked onto a stainless-steel wire in regions where flexibility is desired.[19] After around 17 months of orthodontic treatment, crowding was corrected in both dental arches, followed by deep bite correction (Figures 7 and 8). The treatment is continued by using elastic, as vertical intermaxillary elastics, aimed at extrusion of selected teeth to improve the interdigitation of the dental arches. Furthermore, persistent dental midline deviations may require Class II elastic vector on one side, therefore in this case to help correct the interdigitation and midline shifting, elastic class II was applied on the left arch.[20]

Not all dento-maxillary disharmony in Angle Class I malocclusion can be treated with the same management as this case. Further research is needed on various clinical manifestations of dento-maxillary disharmony in Class I malocclusion and on the management of each case. It is possible, however, to state that adequate diagnosis and treatment planning is essential to define the treatment option that will provide the best treatment results for patients.

## CONCLUSION

Treatment for Angle Class I malocclusion with anterior crowding, midline shifting, and deep bite because

dento-maxillary disharmony in this case managed by orthodontic preadjusted edgewise fixed appliance with premolar extraction showed quite satisfactory progress, which corrected severe crowding of maxilla and mandible, followed by deep bite correction. The type of disharmony, its severity and its etiology on each individual case will guide the therapeutic choice from among the management of the space, the expansion of the arches or the realization of planned extractions. The choice of the appliance started with bracket selection, prescription, wire type and sequencing, leveling-aligning and space closure technique, and anchorage consideration for the optimal orthodontic treatment results.

## Acknowledgments

We thank the patient and Universitas Airlangga Dental Hospital for the consent to publish the photographs and for the case to be presented in this journal.

## Statement of Authorship

All authors participated in data collection and analysis, and approved the final version submitted.

## Author Disclosure

All authors declared no conflict of interest.

## Funding Source

None.

## REFERENCES

1. Alhammadi MS, Halboub E, Fayed MS, Labib A, El-Saaidi C. Global distribution of malocclusion traits: A systematic review. Dental Press J Orthod. 2018 Nov-Dec; 23(6):40.e1-40.e10.
2. Singh G. Textbook of Orthodontics, 3rd ed. India: Jaypee Brothers Medical Publishers (P) Ltd; 2015. pp. 176, 256–261, 453–4554, 615–617.
3. Bakh ES. Evaluation of Treatments Available for Class I , II and III Malocclusion in Children, Adolescents, and Adults [Internet]. 2016 [cited 2019 July]. Available from: http://www.crd.york.ac.uk/PROSPEROFILES/37862_PROTOCOL_20160315.pdf
4. Sid-dick FM, Sidikiba S, Youssouf O, Christian KG, Samba DJ, Barthelemy L. Dento-Maxillary Disharmony by Default in Mixed and Permanent Dentition at Odontostomatology Department of Donka National Hospital, Guinea. Int J Dent Med. 2019; 5(1):9–13.
5. Alam MK, Nowrin SA, Shahid F, Haque S, Imran A, Fareen N, et al. Treatment of angle class I malocclusion with severe crowding by extraction of four premolars: A case report. Bangladesh J Med Sci. 2018;17(4):683–7.
6. Virdi MS. Emerging Trends in Oral Health Sciences and Dentistry. India; 2015. pp. 826.
7. Mageet AO. Classification of Skeletal and Dental Malocclusion: Revisited. Stoma Edu J. 2016; 3(2):205–11.
8. Proffit WR, Fields HW, Larson B, Sarver DM. Contemporary Orthodontics, 6th ed. Philadephia: Elsevier, Inc; 2018. pp. 209, 503.
9. Normando D. Third molars: To extract or not to extract? Dental Press J Orthod. 2015 Jul-Aug; 20(4):17–8.
10. Almpani K, Kolokitha OE. Role of third molars in orthodontics. World J Clin Cases. 2015 Feb; 3(2):132-40.
11. Space Maintainers Laboratories. The Benefits of Using Molar Bands [Online]. 2019 [cited 2019 July]. Available from: https://smlglobal.com/benefits-using-molar-bands
12. Gupta R, Shivaprakash G, Manohar MR, Sonali. Study model-based evaluation of built-in tip, torque, and in-out characteristics of a third-generation preadjusted edgewise appliance. J Contemp Dent Pract. 2018 Jan; 19(1):20–9.
13. Samawi SS. Straight-Wire Orthodontics A Short Guide to Principles and Technique. 1st ed. Samawi Dental and Orthodontic Center; 2014.
14. Ruchi S, Vijay A, Kumar AM, Amit S. 0.018" Versus 0.022" Bracket Slot Systems in Orthodontics : a Review. Unique J Med Dent Sci. 2014;2(4):84–7.
15. Fernandes DJ, Elias CN, Vidal R, Mendes A de M. Mechanical Performance of Nickel-titanium Archwires. Mater Res. 2015;18(6):1264–1277.
16. Sharmila R. Wires in orthodontics - A short review. J Pharm Sci Res. 2016;8(8):895–7.
17. Araghbidikashani M, Hosseinkhatibi A, Merati M, Kojoori SS, Sabzijate M, Badiee M, et al. The Impact of Canine Retraction on Anchorage Loss in Two Methods of Active Lace Back and NiTi Closed Coil Spring. Int J Adv Biotechnol Res. 2017; 8(3):1630–5.
18. Kozel JA, Macedo CR, Atallah ÁN. Laceback ligatures for controlling anchorage in patients undergoing fixed orthodontic treatment. Cochrane Database Syst Rev. 2016 Oct; 2016(10):CD010014.
19. Kopuri RKC, Ambati NR, Indeevar P. Orthodontic Management of an Impacted Central Incisor with a Dual Wire Piggyback Technique. Donn J Dent Oral Hyg. 2015 May; 1(2):7–11.
20. Naini FB, Gill DS. Orthognathic Surgery: Principles, Planning and Practice. UK: John Wiley & Sons; 2017. pp. 307–308.