

Therapeutic Mandibular Incisor Extraction in Orthodontics: An Overview

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ABSTRACT

Therapeutic extraction of a mandibular incisor is an infrequent and possibly underused treatment strategy in Orthodontics. In carefully selected cases, the treatment outcomes are comparable and sometimes better than those with other extraction patterns. This article reviews all factors necessary for the diagnosis, treatment planning, and effective management of such cases.

Key words: Orthodontics, Incisor, Extraction.

The concept of therapeutic extraction of mandibular incisors has evoked a mixed reaction in the Orthodontic world. Angle (1900) believed that removing the lateral incisor (unless with malformed roots) for orthodontic treatment is no longer excusable [1]. Jackson (1904) reported a case where two lower incisors were extracted to correct severe crowding [2]. After nearly four decades since then, Hahn published reports of mandibular incisor extraction in Class III and Class II bimaxillary protrusion (along with 1st premolars) cases in 1941 [3]. Levin (1964) felt that the orthodontic fraternity had successfully treated patients with congenitally missing incisors, and this experience should be translated as a treatment strategy in managing severe lower anterior crowding [4].

Riedel (1976) believed that mandibular incisor extraction was a logical alternative to bicuspid extractions and demonstrated better alignment stability without long-term retention in carefully selected cases of severe lower anterior crowding [5]. Bahreman (1977) published representative

cases treated with mandibular incisor extraction and contended that this option is acceptable if the outcome meets the requirements for a healthier dentition [6]. However, it should be a last resort and not a routine strategy as it involves the most critical area related to stability. Due to the good results, ease of treatment, and increasing employment of this strategy, Tuverson (1980) commented that it is no longer a ‘dastardly act’ and cases treated so are not closet cases [7].

Based on their study of the esthetic perception of anterior occlusion with missing mandibular incisors by dental students, dental professionals, and lay persons, Pithon et al. (2012) suggested that lower central incisor extraction should be rejected whenever other treatment alternatives are available [8]. However, Lee et al. (2019) observed an improvement in the attractiveness of cases treated with lower incisor extraction as adjudged by lay persons and dental students [9]. The comparison with the non-extraction treatment group showed no significant difference; they concluded that mandibular incisor extraction is a valid

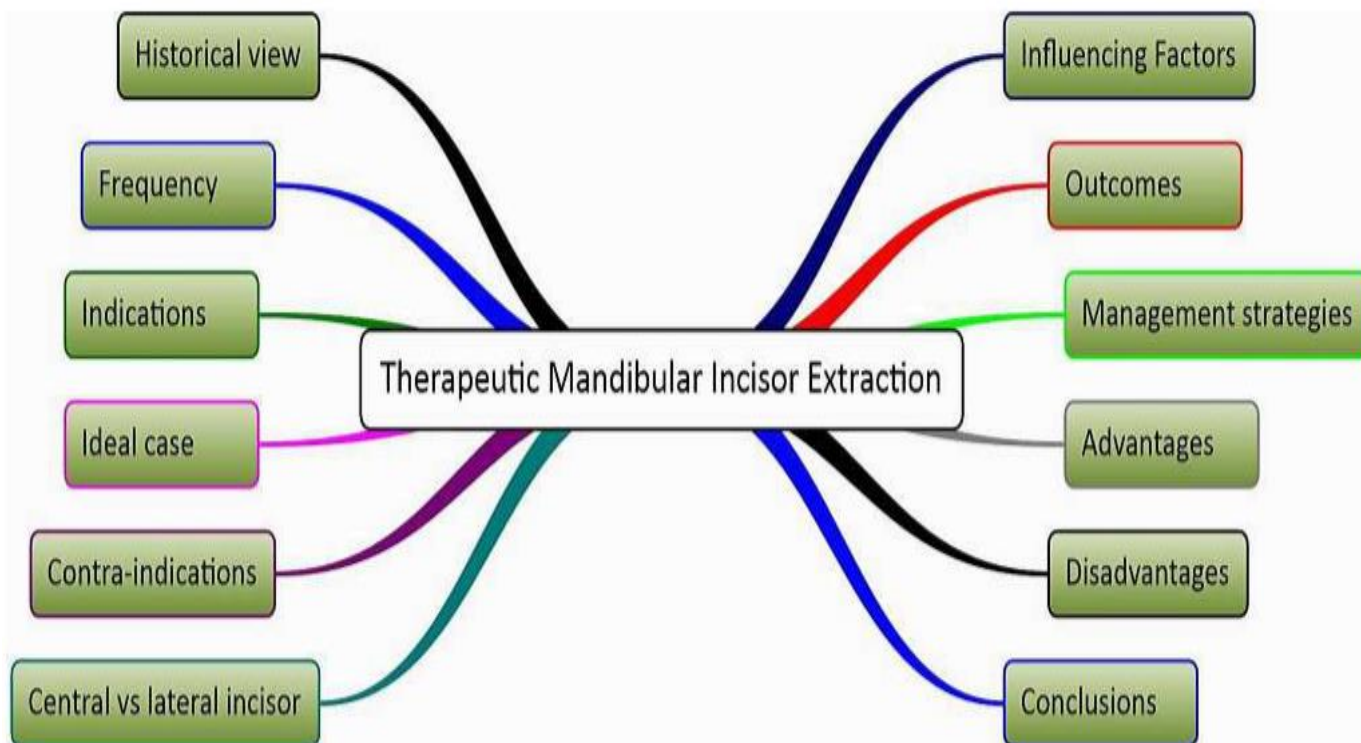


Figure 1: Mindmap of therapeutic mandibular incisor extraction

treatment option. Given the mixed opinion on this strategy, this overview attempts to review the salient aspects of the mandibular incisor extraction for orthodontic treatment. The review outline is presented as a mind map in Figure 1.

Frequency

Proffit estimated that mandibular incisor extractions amounted to 6% of orthodontic extractions in the 1950s but became rare subsequently [10]. A survey on orthodontic treatment procedures found that the frequency of lower incisor extraction was 2.5% and 2.2% in 2002 and 2008, respectively [11].

INDICATIONS

The following are the indications for therapeutic extraction of mandibular incisors [4,6,7,12-21]

1. Class I malocclusions with moderate lower anterior crowding and mandibular anterior tooth material excess.
2. Mild class III malocclusion with end-on incisors / minimal reverse overjet and minimal overbite.
3. Maxillary anterior tooth material deficiency from small or missing incisors

4. Class II malocclusions with ≥ 5 mm space discrepancy and anterior crowding / proclination in mandible. Such cases can be managed by mandibular incisor extraction combined with maxillary teeth IPR in growing patients and maxillary premolar extractions / surgical mandibular advancement in adults.
5. Structurally compromised mandibular incisor (heavy restoration, fracture, endodontically involved, severe enamel hypoplasia, severe attrition, significant dilaceration, etc.)
6. Periodontally compromised lower incisor (gingival recession, dehiscence, bone loss, minimal or absent attached gingiva, pulpo-periodontal lesion).
7. Supernumerary mandibular incisor.
8. Ectopic mandibular incisor including blocked-out, transposed, and transmigrated tooth.
9. To permit anterior repositioning of the retro-positioned mandible in cases with temporomandibular disorders.
10. To achieve necessary overjet and overbite for post-surgical stability after mandibular surgery in cleft lip and palate cases.

Characteristics of case suited for incisor extraction

The best case for treatment with mandibular incisor extraction includes moderate crowding in the mandibular incisor region and minimal or no crowding in the maxillary

arch [6,13,20]. The overjet and overbite should be minimal [22]. An absolute or relative excess of mandibular anterior tooth material of 5 mm, good posterior occlusion, and satisfactory soft-tissue esthetics are essential for a good outcome [6,13,15,20,23,24]. Finally, the results are more predictable when used in cases with permanent dentition after completing the pubertal growth spurt [20,23]. Vilhjálmsón et al. estimated that 3% of Icelandic (and possibly European) orthodontic patients are good cases for incisor extraction rather than expansion/premolar extractions [21].

CONTRAINDICATIONS

Cases with significant anterior maxillary tooth size excess are not good candidates for treatment with lower incisor extraction as this would adversely impact the Bolton discrepancy [6,25]. Malocclusions with a deep overbite and increased overjet are unsuitable as these characteristics worsen [6,7,14,15,17,23,24,26-28]. The presence of triangular-shaped mandibular incisors may predispose to the formation of black triangles (BT) [15,22]. Periodontal disease and high frenal attachment in the extraction site are other contraindications as they may increase the risk of gingival recession and BT [7,14,15,22,23].

CENTRAL VS. LATERAL INCISOR EXTRACTION

In favor of extraction of the central incisor

Greater stability of the results and better symmetry favor the extraction of the central incisor [15,20,29]. It is easier to maintain an upright canine with the central than the lateral incisor extraction [21]. Further, the subsequent contact between the distal surface of the central incisor and canine in cases with lateral incisor extraction is not ideal and predisposes to future periodontal problems [29].

In favor of extraction of the lateral incisor

Generally being slightly wider in size, the extraction of a lateral incisor gives marginally more space than central incisors [21,23]. A better interproximal contact is possible between the mesial surfaces of the remaining central incisor and the canine [30,31]. The lesser chance of a midline black triangle formation and the less visibility of the extraction site from the front are other advantages of extraction of the lateral incisor [6,24,30,31].

Factors influencing the tooth to be extracted

The periodontal health of the incisor is a crucial factor in deciding the tooth for extraction [6,15,18]. While the earlier recommendation was to extract the compromised tooth, in the current view, the extraction of teeth with gingival recession or bone defect is not indicated as the problem may persist [20,23]. Hence it is recommended to decide on the tooth to be extracted after the necessary periodontal interventions and outcome assessment. Vilhjálmsón et al. suggested removing the tooth with good bone levels to prevent the formation of a black triangle [21]. Teeth with extensive restorations, unfavorable endodontic prognosis, enamel decalcification and defects, and severe attrition must be preferred over better ones [24]. The most displaced tooth, and those at the site of crowding would be a natural choice [14,21,24]. Other deciding factors include space requirement, Bolton discrepancy, midline relation, the angulation of the adjacent canine, and the shape of the teeth [6,15,24,31].

OUTCOMES

In prudently selected cases, extraction of a mandibular incisor can yield a good occlusal outcome (alignment, intercuspation, overbite, and overjet) [16]. The esthetic outcome is generally satisfactory. In contrast to non-extraction and premolar extractions, lower incisor extraction results in better stability and less critical retention due to no change or even a mild reduction in the intercanine width [12,23]. Overall, the results with mandibular incisor extraction are generally more favorable or at least comparable to cases treated with non-extraction or premolar extractions [5,12,32].

Strategies for effective case management

Careful case selection and planning are the keys to successfully managing such cases. A complete Kesling set-up is mandatory in these cases, and they are better predictive of occlusal results than tooth-size formulae [7,13,19,23,25]. Interproximal reduction of the maxillary teeth may be required to resolve tooth material excess [13,23,25,26]. IPR of the other mandibular incisors may frequently be necessary to correct the residual Bolton discrepancy or reshape the incisors to reduce the black triangle [22,24,28]. Optimum angulation (Parallelism) of the roots of other incisors is essential to minimize the formation of black triangles [7,28].

The occlusal interference resulting from the mandibular canine can be addressed using the following measures [15,25]. The strategies involving the mandibular canines include coronoplasty to remove the non-functioning cusp portions, placing them upright or with mild distal crown angulation, and making their distal side more prominent by using arch wire offsets [25]. Reducing their mesial movement by consuming the excess space by artistic positioning of the lower incisor, reproximation of the maxillary incisors and moving them mesially, positioning the maxillary canine crowns with mesial angulation, and shifting to the group function scheme are other options [25]. Also, the lower incisors can be extruded to sustain contact in centric occlusion [25].

The following biomechanical and mechanotherapeutic considerations help efficient management of lower incisor extraction cases [28]. The bracket angulations/tip prescription may need to be customized to achieve optimal root positioning of incisors and canines [7,33]. More gingival placement of brackets in the anteriors moves the force closer to their centre of resistance, reducing their tipping. It is recommended to use the largest possible rectangular wire for space closure as round/ flexible wires allow tipping of teeth at the extraction site and lingual tipping of canine and increase its overbite [28]. When the incisor malocclusion is symmetrical and accompanied by mesially tipped canine on one side and distally tipped on the other, extraction of the lateral incisor on the latter side may simplify the canine movement without excessive mesial tipping [31]. The use of clear aligners in lower incisor extraction cases is becoming frequent, and an estimated 7.2% of lower incisor extraction cases in 2008 were treated with these appliances [10].

The formation of the black triangle in these cases is a multifactorial problem. The distance of the interproximal contact from the alveolar crest is a crucial parameter, and the interdental papilla is present almost always when this is within 5 mm [34]. Other vital factors are triangular incisor crowns, high interproximal contact, severe incisor crowding, predisposition to periodontal disease, mesial angulation of teeth/root divergence, duration of treatment and extent of intrusion [7,24,25,28,35,36]. The risk of BT formation is generally higher in non-growing and older individuals. Vilhjalmsen et al. suggested extraction site preparation to maintain bone height and reduce the frequency of BT formation in lower incisor extraction cases [21]. In this protocol, the tooth selected for

extraction (one with good periodontal support) is tipped lingually, and the space closure is initiated. The tooth extraction is done after lingual tipping of around 45 degrees is achieved. They recommend this procedure to conserve the crestal bone height at the extraction site in all individuals less than 40 years.

ADVANTAGES

Maintenance of the intercanine width and the overall arch form are definite advantages of lower incisor extraction [6,18,23]. It reduces the anchorage requirement and the use of maxillo-mandibular elastics [18]. The availability of extraction space at the site of crowding simplifies the treatment and reduces both the overall treatment duration and retention time [4,18,19,21,23,25,28].

It reduces or eliminates the need for arch expansion, allows simple treatment mechanics, improves parallelism, and reduces the proximity of roots of mandibular anteriors [4,6,18,19,25]. This option is less damaging to supporting structures than other space gaining modalities and yields more stable results than premolar extractions for severe crowding cases [12]. Minimal changes in the profile and improvement in Class III cases are an added advantage [4,6,13,25]. Finally, it offers a faster treatment solution for adults and relapse cases [6,25].

DISADVANTAGES

The common problems encountered in treating cases with lower incisor extraction include an increase in overbite and overjet, lingual tipping of the other incisors, and more mesial post-treatment positioning of the canine resulting in interference during protrusion and loss of canine guidance during lateral excursions [14,20,25]. Other concerns are the higher risk of BT formation (68%), the iatrogenic Bolton discrepancy' midline discordance, and the unsightly and evident extraction space during treatment [12,14,18,19,21,24,28].

If the space created is inadequate in cases with severe crowding and proclination of anteriors, further space gaining procedures may be required. On the contrary, if extraction space exceeds the requirement to resolve the tooth size-arch length discrepancy or the overjet, a reduction in arch length and sub-optimal posterior teeth interdigitation may result [16,25]. Mild relapse in cases with severe pre-treatment crowding and space reopening are other long-term problems noted in these cases

[12,14,18,19,22,23,27]. Sometimes, the color difference between lateral incisor and canine may concern the patient [18]. Frequently, the treatment turns out to be more complicated and more prolonged than anticipated at the start [22].

CONCLUSION

The therapeutic extraction of mandibular incisors can produce satisfactory outcomes of contemporary Orthodontic standards. Careful case selection, meticulous planning, and prompt handling of the anticipated problems are the keys to the effective management of such cases.

REFERENCES

1. Treatment of malocclusion of the teeth and fractures of the maxillae; Angle's system. 6th ed. Philadelphia: White Dental Manufacturing Co.; 1900.
2. Jackson VH. Orthodontia and orthopaedia of the face. Philadelphia: Lippincott; 1904.
3. Hahn GW. Problems in the Treatment of Malocclusion*. Angle Orthod. 1942; 12:61–82.
4. Levin S. An Indication for The Three Incisor Case. Angle Orthod. 1964; 34:16–24.
5. Riedel RA, Brandt S. Dr. Richard A. Riedel on retention and relapse. J Clin Orthod. 1976; 10:454–72.
6. Bahreman AA. Lower incisor extraction in orthodontic treatment. Am J Orthod. 1977; 72:560–7.
7. Tuverson DL. Anterior interocclusal relations. Part II. Am J Orthod. 1980; 78:371–93.
8. Pithon MM, Santos AM, Couto FS, et al. Perception of the esthetic impact of mandibular incisor extraction treatment on laypersons, dental professionals, and dental students. Angle Orthod. 2012; 82:732–8.
9. Lee S, Firth FA, Bennani F, et al. Evaluation of objective and subjective treatment outcomes in orthodontic cases treated with extraction of a mandibular incisor. Angle Orthod. 2019; 89:862–7.
10. Proffit WR. Forty-year review of extraction frequencies at a university orthodontic clinic. Angle Orthod. 1994; 64:407–14.
11. Keim RG, Gottlieb EL, Nelson AH, et al. 2008 JCO study of orthodontic diagnosis and treatment procedures, part 1: results and trends. J Clin Orthod. 2008; 42:625–40.
12. Riedel RA, Little RM, Bui TD. Mandibular incisor extraction--postretention evaluation of stability and relapse. Angle Orthod. 1992; 62:103–16.
13. Owen AH. Single lower incisor extractions. J Clin Orthod. 1993; 27:153–60.
14. Canut JA. Mandibular incisor extraction: indications and long-term evaluation. Eur J Orthod. 1996; 18:485–9.
15. Matsumoto MAN, Romano FL, Ferreira JTL, et al. Lower incisor extraction: an orthodontic treatment option. Dental Press J Orthod. 2010; 15:143–61.
16. Zhylich D, Suri S. Mandibular incisor extraction: a systematic review of an uncommon extraction choice in orthodontic treatment. J Orthod. 2011; 38:185–95; quiz 231.
17. Youssef J, Skaf Z. Missing or extraction of a mandibular incisor in orthodontics. J Dent Health Oral Disord Ther. 2015; 2:180–7.
18. Brandt S, Safirstein GR. Different extractions for different malocclusions. Am J Orthod. 1975; 68:15–41.
19. Klein DJ. The mandibular central incisor, an extraction option. Am J Orthod Dentofacial Orthop. 1997; 111:253–9.
20. Rosenstein SW. A lower incisor extraction? Aust Orthod J. 1976; 4:107–9.
21. Vilhjálmsson G, Zermeno JP, Proffit WR. Orthodontic treatment with removal of one mandibular incisor: Outcome data and the importance of extraction site preparation. Am J Orthod Dentofacial Orthop. 2019; 156:453–63.
22. Faerovig E, Zachrisson BU. Effects of mandibular incisor extraction on anterior occlusion in adults with Class III malocclusion and reduced overbite. Am J Orthod Dentofacial Orthop. 1999; 115:113–24.
23. Valinoti JR. Mandibular incisor extraction therapy. Am J Orthod Dentofacial Orthop. 1994; 105:107–16.
24. Uribe F, Holliday B, Nanda R. Incidence of open gingival embrasures after mandibular incisor extractions: a clinical photographic evaluation. Am J Orthod Dentofacial Orthop. 2011; 139:49–54.
25. Kokich VG, Shapiro PA. Lower Incisor Extraction in Orthodontic Treatment: Four Clinical Reports. Angle Orthod. 1984; 54:139–53.
26. Sheridan JJ, Hastings J. Air-rotor stripping and lower incisor extraction treatment. J Clin Orthod. 1992; 26:18–22.
27. Dacre JT. The long-term effects of one lower incisor extraction. Eur J Orthod. 1985; 7:136–44.
28. Uribe F, Nanda R. Considerations in mandibular incisor extraction cases. J Clin Orthod. 2009; 43:45–51.
29. Prakash N, Mohammed F, Sundareswaran S. Extracting one mandibular incisor. Am J Orthod Dentofacial Orthop. 2020; 157:440–1.
30. Neff CW. The Size Relationship Between the Maxillary and Mandibular Anterior Segments of the Dental Arch. Angle Orthod. 1957; 27:138–47.
31. Berger H. The Lower Incisors in Theory and Practice. Angle Orthod. 1959; 29:133–48.
32. Kamal AT, Shaikh A, Fida M. Improvement in Peer Assessment Rating scores after non-extraction, premolar extraction, and mandibular incisor extraction treatments in patients with Class I malocclusion. Am J Orthod Dentofacial Orthop. 2017; 151:685–90.
33. Alexander RG. Space closure in patients with missing mandibular incisors. J Clin Orthod. 2008; 42:467–73; quiz 455–6.
34. Tarnow DP, Magner AW, Fletcher P. The effect of the distance from the contact point to the crest of bone on the presence or absence of the interproximal dental papilla. J

- Periodontol. 1992; 63:995–6.
35. An SS, Choi YJ, Kim JY, et al. Risk factors associated with open gingival embrasures after orthodontic treatment. *Angle Orthod.* 2018; 88:267–74.
 36. Ikeda T, Yamaguchi M, Meguro D, et al. Prediction and causes of open gingival embrasure spaces between the mandibular central incisors following orthodontic treatment. *Aust Orthod J.* 2004; 20:87–92.

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