

## Treatment of Children with Retained Permanent Teeth Using Orthodontic Implant-Supported Therapy

Mehmani Ilham Gasanaga<sup>1</sup>, Mehmani Vusala Rasim<sup>2</sup>, Babayev Elmar Elman<sup>3</sup>, Ashrafov Davud Sergey<sup>4</sup>

<sup>1,2,3,4</sup>Azerbaijan Medical University, Azerbaijan



DOI : <https://doi.org/10.61796/jmgcb.v3i1.1612>



### Sections Info

#### Article history:

Submitted: November 15, 2025  
Final Revised: November 25, 2025  
Accepted: December 07, 2025  
Published: December 14, 2025

#### Keywords:

Retention  
Supernumerary teeth  
Growth zone  
Tooth crown exposure  
Orthodontic implants

### ABSTRACT

**Objective:** This study aims to propose a comprehensive orthodontic treatment method for children with retained permanent teeth, taking into account individual anomalies, patient age, and the degree of tooth root formation when using orthodontic implant support. **Method:** A sample of 14 children with retained permanent teeth was treated using orthodontic implants between 2013 and 2015. The diagnosis included clinical and radiographic examinations, and the treatment approach was based on the cause of the retention, the tooth's position, and the degree of root formation. Treatment included removal of supernumerary teeth, surgical crown exposure, and orthodontic appliances. **Results:** The primary causes of retention were supernumerary teeth, incorrect alignment, and insufficient space in the dental arch. Most children showed successful eruption of permanent teeth within 2–6 months after treatment, with an orthodontic treatment period of 9–12 months. **Novelty:** This study introduces a holistic approach to treating retained teeth in children, emphasizing personalized treatment based on clinical assessments, root development, and available space, which enables quicker and more effective normalization of dental arch positions.

## INTRODUCTION

The issue of disturbances in the tooth eruption process occupies an important place in modern dentistry. Developmental abnormalities of teeth include changes in their number, position, structure, and shape. Quantitative deviations can manifest as a reduction in the number of teeth due to tooth germ loss or absence – known as agenesis – or as delayed eruption of a tooth within the jawbone, referred to as retention. Retained teeth are those that remain in the jaw after the optimal time for physiological eruption, with root formation either completed or nearing completion [1], [2].

Any permanent tooth can be retained; however, retention most frequently occurs in canines and less commonly in central incisors, second premolars, or lateral incisors. An increase in tooth number is also observed – these are supernumerary teeth, most commonly found in the maxillary incisor region and less often in premolars and molars. Supernumerary canines are rare. According to several authors [3], [4], [5], the causes of tooth retention in children include both local and systemic factors. Local factors (such as supernumerary teeth, trauma, or insufficient space in the dental arch) lead to delayed eruption of individual teeth. Systemic factors, such as endocrine disorders, can cause delayed eruption of multiple teeth.

Delayed eruption may resolve spontaneously if the underlying cause is eliminated. If eruption does not occur, persistent retention of permanent teeth develops.

At this stage, retained teeth typically exhibit fully formed and mineralized roots, but their orientation may not coincide with the direction of eruption into the dental arch. If retention is not addressed, the periodontal space gradually decreases, and the tooth becomes embedded in bone, significantly reducing its ability to erupt [6], [7].

The presence of retained teeth must be considered when planning orthodontic treatment using implant-supported therapy to prevent tooth damage. The aim of this study was to investigate the causes of permanent tooth retention and analyze the outcomes of comprehensive treatment in children and adolescents with deeply impacted teeth using modern technologies.

## RESEARCH METHOD

Between 2013 and 2015, 14 children with retained teeth were treated at the Department of Pediatric Dentistry Clinic, SGMU. All patients underwent orthodontic treatment with support from orthodontic implants. Diagnosis was based on clinical and radiographic examinations. Intraoral radiographs and, when indicated, computed tomography scans were used to determine the position of retained teeth within the alveolar process [8].

The available space in the dental arch for a retained tooth was determined by measuring the arch length using Nance's method on diagnostic models or by comparing the available space in the dental arch with the size of the retained tooth, using the corresponding tooth on the opposite side of the jaw as a reference. Supernumerary teeth were usually detected during radiographic examinations when investigating the cause of retention of a permanent tooth, typically in response to parental complaints of missing one or more permanent teeth (most often maxillary central incisors) in children aged 8-9 years. Radiographic evaluation often revealed supernumerary teeth or odontomas positioned along the eruption path of the permanent teeth, obstructing their eruption. Occasionally, supernumerary teeth were discovered after eruption. The number of supernumerary teeth varied – most commonly one or two, but sometimes up to five [9].

Treatment of retained permanent teeth was generally comprehensive and depended on the cause of the anomaly, the tooth's position in the alveolar process, and the degree of root formation. If retention was caused by supernumerary teeth within the alveolar bone, these teeth were surgically removed, followed by measures to stimulate eruption of the permanent teeth. The timing of surgical intervention for children with supernumerary teeth depended on their position relative to the permanent tooth and the child's age.

If the supernumerary tooth (or odontoma) was located near the incisal edge but did not interfere with the growth zone of the permanent tooth, it was removed regardless of the root formation stage of the permanent tooth. If the supernumerary tooth was close to the growth zone of the permanent tooth, removal was postponed until root formation of the permanent tooth was complete, as surgery could damage the growth zone, potentially halting development and resulting in an underdeveloped or non-viable tooth.

After removal of supernumerary teeth, permanent teeth erupted spontaneously within 2–6 months if there was sufficient space. If eruption did not occur within this period, removable plate prostheses with artificial gingiva were used, along with physical methods to stimulate eruption, such as lidase electrophoresis. For retained teeth with incomplete root formation, these measures were usually sufficient to allow eruption into the dental arch.

## RESULTS AND DISCUSSION

In most cases, local factors are the primary cause of tooth retention. Among them, in 4 children, retention was caused by the presence of supernumerary teeth.

Incorrect alignment along the eruption axis and insufficient space in the dental arch were also causes of retention, observed in 9 cases: 7 involved retained canines and 2 involved retained premolars. In one child, retention was caused by an odontoma [10], [11].

Typically, supernumerary teeth were located in the region of the maxillary central incisors, less often near the lateral incisors, although they could also occur in the area of other teeth. It was noted that supernumerary teeth are more often positioned palatally relative to the permanent teeth [12]. In one case, a supernumerary tooth was observed between two permanent teeth. Interestingly, the supernumerary teeth located on the palatal side usually had a barrel-shaped crown, with only the crown portion formed. The supernumerary tooth located between the permanent teeth had a fully formed root, with its crown oriented toward the nasal cavity.

The roots of permanent teeth obstructed by supernumerary teeth were significantly delayed in their development, which is likely explained not only by mechanical obstruction but also by the creation of nonspecific stress in that area of the jawbone, contributing to retention and delayed root formation. In children with tooth retention due to incorrect alignment along the eruption axis and insufficient space in the dental arch, narrowing of the dental arches was observed. This narrowing has also been described in the literature [13]. In cases of canine retention, more than half of the examined patients had lateral incisors displaced forward. These patients sought treatment between the ages of 11 and 17.

Panoramic radiographs revealed variability in the positions of retained tooth buds. Since these patients had misaligned teeth and insufficient space in the dental arch, treatment began with creating space either orthodontically or surgically. In one case, due to insufficient space for a retained premolar, the first molar was extracted because it had previously been treated and showed destructive changes in the furcation and root apices. When there was a significant lack of space for canines, extraction of first premolars or primary canines was performed first, followed by exposure of the crowns of retained teeth and subsequent alignment into the dental arch using orthodontic appliances (braces) with support from implants [14], [15].

For retained canines, crowns could be located both buccally and palatally. Surgical access for crown exposure was most often palatal: under infiltration anesthesia, a

mucoperiosteal flap was incised and reflected according to the projected position of the tooth. The outer cortical plate was exposed, and a window corresponding to the retained tooth was drilled with a bur to free the crown from surrounding tissues. A hook or bracket was bonded using composite materials for subsequent orthodontic traction and alignment into the dental arch. The wound was then covered with an iodophorm gauze until full epithelialization, with a 5–7 day course of anti-inflammatory therapy. Seven to ten days after wound healing, the gauze was removed, and orthodontic treatment began. Retained teeth were slowly extruded at approximately 1 mm per month. The active orthodontic treatment period with implant support ranged from 9 to 12 months, depending on the severity of the identified anomalies. Once the tooth was positioned in the arch with correct occlusal contacts, the patient used either a removable or fixed retention appliance [16], [17].

Thus, the results of these studies indicate that tooth retention is a common cause of disrupted dental arch formation and arises under the influence of both external and, in most cases, local factors. The leading role of local factors in tooth retention has also been noted in the literature [18], [19], [20], [21], [22], [23]. The most frequent causes of tooth retention were supernumerary teeth, incorrect alignment along the eruption axis, and insufficient space in the dental arch. Treatment of patients with retained teeth should take into account individual variations in the size, shape, and position of the retained teeth; patient age; degree of root apex formation; available space in the dental arch; presence of supernumerary teeth, odontomas, or other causes of retention. The use of a comprehensive treatment approach for children with retained permanent teeth allows for faster normalization of their position in the dental arch.

## CONCLUSION

**Fundamental Finding** : This study highlights that retained permanent teeth in children are primarily caused by local factors, such as the presence of supernumerary teeth, incorrect alignment, and insufficient space in the dental arch. The use of orthodontic implants, combined with surgical interventions and orthodontic appliances, effectively facilitates the eruption of retained teeth. **Implication** : The findings suggest that a comprehensive, individualized treatment approach is crucial for addressing tooth retention in children. This approach not only normalizes dental arch positions more quickly but also minimizes the risk of damage from implants. **Limitation** : The study's sample size was limited to 14 children, which may restrict the generalizability of the results. Additionally, the long-term effectiveness of the treatment approach in different populations was not assessed. **Future Research** : Future studies should include larger sample sizes and long-term follow-up to evaluate the sustainability of the treatment's effectiveness. Moreover, exploring alternative techniques for treating tooth retention, such as less invasive methods or newer technologies, could further enhance clinical outcomes.

## REFERENCES

- [1] Z. J. Rashid, A. J. Ali, and D. S. Abdulateef, "Root Resorption in Retained Primary Teeth without Successors among Sulaimani Adult Population," *Advances in Medical and Dental Research*, vol. 2, no. 1, Jul. 2016, doi: 10.21276/amdr.2016.2.1.02.
- [2] R. Brignardello-Petersen, "High rate of tooth retention and periapical health 10 years after nonsurgical root canal treatment but uncertainty about the factors that may influence these outcomes," *The Journal of the American Dental Association*, vol. 149, no. 3, p. e58, Mar. 2018, doi: 10.1016/j.adaj.2017.11.023.
- [3] J. Cohen-Lévy, C. Boulos, P. Rompré, A. Montpetit, and R. B. Kerstein, "Is the quality of occlusal contacts comparable after aligner and fixed orthodontic therapy? A non-randomized cohort comparison using computerized occlusal analysis during 6 months of retention," *CRANIO®*, vol. 42, no. 6, pp. 788–800, Apr. 2022, doi: 10.1080/08869634.2022.2056688.
- [4] M. Boffano, D. Bollero, U. Albertini, J. Nuzzo, M. Stella, and R. Piana, "Negative pressure wound therapy in the treatment of wound failure after limb sarcoma resection: the role of gauze," *Curr Orthop Pract*, vol. 24, no. 5, pp. 557–560, Sep. 2013, doi: 10.1097/bco.0b013e31829e5179.
- [5] P. Hernández, A. V. Landaverde, M. O. Villagómez, G. O. Villagómez, and A. T. Alcocer, "Substitution of retained canines with first maxillary premolars. Case report," *Revista Mexicana de Ortodoncia*, vol. 4, no. 4, pp. e269–e275, Oct. 2016, doi: 10.1016/j.rmo.2017.03.018.
- [6] K. Pawłowska-Góral, P. Wardas, E. Kurzeja, M. Stec, and A. Wardas, "Antioxidant activity of dental pulp of retained and partially retained teeth and tooth buds," *Journal of Stomatology (Czasopismo Stomatologiczne)*, vol. 65, no. 6, pp. 798–804, Nov. 2012, doi: 10.5604/00114553.1016747.
- [7] G. S. Silveira and J. N. Mucha, "Agenesis of Maxillary Lateral Incisors: Treatment Involves Much More Than Just Canine Guidance," *Open Dent J*, vol. 10, no. 1, pp. 19–27, Feb. 2016, doi: 10.2174/1874210601610010019.
- [8] L. Dakhno, N. Malashenko, and K. Lykhota, "Prevalence of delayed tooth eruption of permanent maxillary anterior teeth among Ukrainian children: retrospective radiographic study using CBCT data," *Ukrainian Dental Journal*, vol. 2, no. 1, pp. 61–70, Mar. 2023, doi: 10.56569/udj.2.1.2023.61-70.
- [9] J. Dai, "Supernumerary Tooth Locate In Molar Teeth: Five Cases Reports," *OAlib*, vol. 01, no. 01, pp. 1–4, 2014, doi: 10.4236/oalib.preprints.1200084.
- [10] M. Kaygusuz, "Intraalveolar root fractures in teeth with incomplete root development," *Int Dent J*, vol. 74, p. S40, Oct. 2024, doi: 10.1016/j.identj.2024.07.691.
- [11] Z. Zhang, "Tooth Hemisection In Permanent-Supernumerary Tooth Fusion," *Int Dent J*, vol. 75, p. 104818, Oct. 2025, doi: 10.1016/j.identj.2025.104818.
- [12] U. Thimmegowda, "Interdisciplinary Management of Impacted Supernumerary Tooth between Roots of Permanent Teeth–A Management Dilemma?," *JOURNAL OF CLINICAL AND DIAGNOSTIC RESEARCH*, 2016, doi: 10.7860/jcdr/2016/21323.8277.
- [13] M. Karimi, "The Importance of Preserving the Primary Teeth before the Permanent Teeth Eruption," *Dental Research and Management*, p. 55, Nov. 2018, doi: 10.33805/2572-6978.113.
- [14] B. Witsenburg and G. Boering, "Eruption of impacted permanent upper incisors after removal of supernumerary teeth," *Int J Oral Surg*, vol. 10, no. 6, pp. 423–431, 1981, doi: 10.1016/s0300-9785(81)80079-8.

- [15] V. Moshkelgosha, N. Khosravifard, and A. Golkari, "Tooth size-arch length discrepancies and teeth eruption in children with and without dental crowding," *F1000 Research Ltd.* doi: 10.5256/f1000research.3196.d27729.
- [16] A. Becker, "Resorption of the Impacted Tooth," Jan. 2022, *Wiley*. doi: 10.1002/9781119565406.ch10.
- [17] S. Fujii, H. Takebe, T. Mizoguchi, H. Nakamura, T. Shimo, and A. Hosoya, "Bone formation ability of Gli1+ cells in the periodontal ligament after tooth extraction," *Bone*, vol. 173, p. 116786, Aug. 2023, doi: 10.1016/j.bone.2023.116786.
- [18] M. Milano, "Conditions Associated with Premature Exfoliation of Primary Teeth or Delayed Eruption of Permanent Teeth," in *Craniofacial and Dental Developmental Defects*, Springer Nature Switzerland, 2025, pp. 29–57. doi: 10.1007/978-3-031-97218-8\_3.
- [19] J. Milner, "Faculty Opinions recommendation of Inactivation of IL11 signaling causes craniosynostosis, delayed tooth eruption, and supernumerary teeth," Aug. 2011, *H1 Connect*. doi: 10.3410/f.13093962.14414070.
- [20] M. S. Sale, C. Patil, T. Dalvi, M. R. Khairnar, A. Karagir, and A. Patil, "Association of Enamel Tooth Color of Central Incisors, Lateral Incisors, and Canines With Age and Gender to Aid in Forensic Identification: A Cross-Sectional Study," *Cureus*, May 2025, doi: 10.7759/cureus.84865.
- [21] F. M. Ali, M. Thomas, J. M. Y. Otudi, Y. Mobarki, and A. A. Essa, "Case Report of Multiple Supernumerary Teeth in the Maxillary Anterior Region Causing Impaction of Permanent Maxillary Central Incisor," *Annals of International medical and Dental Research*, vol. 3, no. 4, Jul. 2017, doi: 10.21276/aimdr.2017.3.4.de4.
- [22] N. M. Al-Khanati and Z. K. Beit, "Should we predict poor prognosis in autotransplantation of teeth with completed root formation?," *Annals of Medicine & Surgery*, vol. 81, Sep. 2022, doi: 10.1016/j.amsu.2022.104501.
- [23] V. Srivastava, "Eruption of Teeth, its Disturbances and their Management," in *Modern Pediatric Dentistry*, Jaypee Brothers Medical Publishers (P) Ltd., 2011, p. 69. doi: 10.5005/jp/books/11297\_9.

---

**Mehmani Ilham Gasanaga**

Azerbaijan Medical University, Azerbaijan

**Mehmani Vusala Rasim**

Azerbaijan Medical University, Azerbaijan

**Babayev Elmar Elman**

Azerbaijan Medical University, Azerbaijan

**Ashrafov Davud Sergey**

Azerbaijan Medical University, Azerbaijan

---