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# Root canal treatment in a spina bifida patient with developmental root-canal anomaly: Case Report

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## Abstract

Neural tube defects are common congenital malformations that could be apparent at birth or manifested in later stages of life. Spina bifida is a type of neural tube defect that results from failure of neural tube closure during the first month in utero. Predisposition to dental caries, latex allergy, and craniosynostosis causing maxillary deficiency are some of the key problems in spina bifida.

Normal root development results from the induction between the hertwig epithelial root sheath and the dental papilla after enamel formation, whereas root anomalies are caused by complex interactions between genetic, epigenetic and environmental factors during these stages. It is very important to make the correct diagnosis in patients with special conditions and to start root canal treatment by considering various variations in order to achieve success. In this case, we present the root canal treatment of a patient diagnosed with spina bifida who presented to our clinic with pain in the right lower molar tooth and developmental root shape anomaly in the mandibular first molar teeth.

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**Keywords:** Spina bifida, Root-canal anomalies, Root canal treatment, Molar-incisor malformation.

## INTRODUCTION

In tooth development, after crown formation, root development begins with the interaction between the Hertwig epithelial root sheath and the dental papilla originating from ectomesenchyme. The dental papilla differentiates into odontoblasts to form dentin and pulp, while the Hertwig epithelial root sheath is associated with root number and morphology. However, as with the mechanism underlying crown formation, how root formation occurs has not yet been fully elucidated. Root malformations are the result of various genetic and developmental factors (1).

When pathologic conditions of root development are analyzed, short roots or absent roots are most often due to hard tissue resorption. Such secondary anomalies, which usually affect single teeth or small groups of teeth, often develop as a result of dentoperiodontal trauma, local inflammation, orthodontic tooth movement, endocrine disorders or tumors (2).

More rarely, radicular dysplasias can also develop as a result of a primary disruption or early disruption of normal root formation. Primary disruption of root development is associated with dentin dysplasia type 1 and regional odontodysplasia. In these two conditions, root dysplasia may be generalized or affect a specific part of the dental arch (3).

The most common root malformations can be subdivided into disorders of root development only and disorders of root development associated with a generalized dental dysplasia. Disorders of root

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development only include: premature cessation of root formation due to an external adverse effect, root enlargement, molar incisor malformation, short root anomaly, taurodontism. Disorders of root development associated with general dental dysplasia include; double teeth, regional odontodysplasia, hypophosphatasia, dentin dysplasia type I (2).

Neural tube defects are malformations related to abnormal neural tube closure. They occur between the third and fourth weeks of gestation and cause structural defects anywhere along the neural axis from the developing brain to the sacrum (4).

Genes play a common role in the development of neural tube defects by interacting with environmental factors. Genes such as Sonic Hedgehog, dishevelled and thermolabile variant of methylenetetrahydrofolate reductase (MTHFR) have been implicated in neural tube defects. In infants with mutations in the folate receptor-a gene, the risk of neural tube defects is increased due to decreased binding affinity for 5-MTHF, the physiologic form of folic acid. Neural tube defects can also be caused by hyperhomocysteinemia resulting from deficiency of vitamins B6, B11 and B12, which are involved in the methylation cycle. Low socioeconomic status, smoking, excess vitamin A, zinc deficiency and high levels of organic matter have been shown to be risk factors for neural tube defects. Maternal obesity, diabetes, colds in the first trimester, hyperthyroidism, stress, hyperthermia and infections have been found to be associated with neural tube defects. Antiepileptic drug use during pregnancy is associated with an increased risk of neural tube defects due to free radical-induced damage (4).

Spina bifida is a congenital malformation of the spinal cord associated with various vertebral abnormalities caused by incomplete closure of the neural tube. It is one of the most common malformations of the central nervous system (5).

Another issue that requires extra care during dental treatments is that patients with spina bifida are allergic to latex and the incidence of this allergy varies between 28% and 67%. As a matter of fact, it has been reported that 64% of spina bifida patients who have undergone more than one procedure are sensitized to latex and many of them experience life-threatening reactions (5).

In recent years, several case reports have presented root anomalies, usually involving the first permanent molars, rarely the deciduous second molars and the permanent upper central incisors. In this article, we present a case of root canal treatment of a patient diagnosed with spina bifida suggestive of an anomaly called molar incisor malformation or molar root-incisor malformation.

## CASE REPORT

An 11-year-old male patient was admitted to our clinic with the complaint of nocturnal pain in the right mandibular region for about a week. In the anamnesis, it was learned that the patient had a history of spina bifida and had undergone surgery when he was three years old. In the anamnesis, it was learned that the patient had no history of allergy. A panoramic radiograph was obtained from the patient and root shape anomaly was observed in the mandibular first molars. Periapical radiograph obtained from the right lower mandibular region revealed a lesion in the apical part of the lower right first permanent teeth. Palpation was negative and percussion was positive. On clinical examination, no mobility, extraoral swelling, gingival abscess or fistula was observed. The patient's parents were informed about possible treatment options and it was decided to perform routine root canal treatment. Written informed consent was obtained from the family and root canal treatment was started on the lower right first permanent teeth . Latex-free materials were used for prophylactic purposes during the treatment. The endodontic cavity was prepared for root canal treatment with diamond rond and steel rond burs. A single canal entrance was found mesial to the pulp chamber floor. The working length of the mesiobuccal canal was first measured using an apex locator. Then, a number 10 K-file file was inserted into the root canal and periapical X-rays were taken and the measurement made with the apex locator was confirmed. The canal was expanded with endomotor files following the step-back technique. The first session ended with the placement of calcium hydroxide into the canal and temporary resorption following the root canal enlargement. The patient was recalled two weeks later. The canal was irrigated with 2.5% sodium hypochlorite and saline was used as the final flushing agent. The canal was dried and filled at the working length determined by the lateral condensation technique. The final restoration was made with composite. Informed consent form was obtained from the patient's parents to give permission for publication. The patient was followed up at the 1st and 3rd month follow-up visits and it was determined that the

patient's complaints were resolved and the lesion started to shrink in the periapical X-rays taken at both visits.

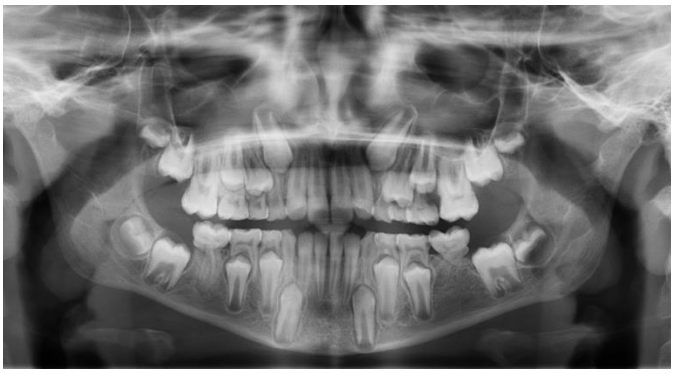

**Figure 1.** Panoramic X-ray image of the patient.

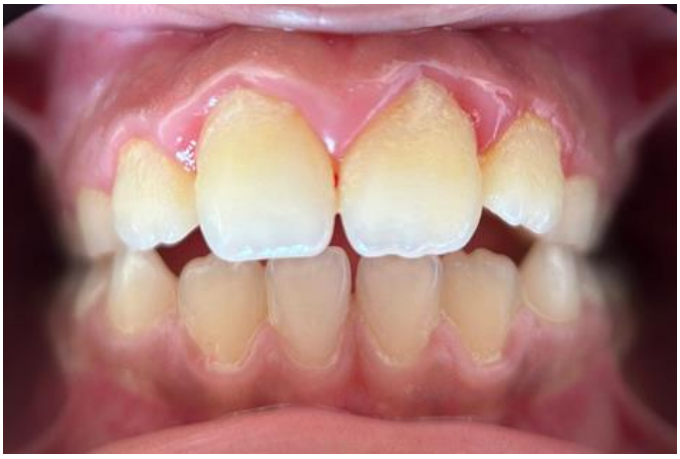

**Figure 2.** Anterior intraoral bite image of the patient.

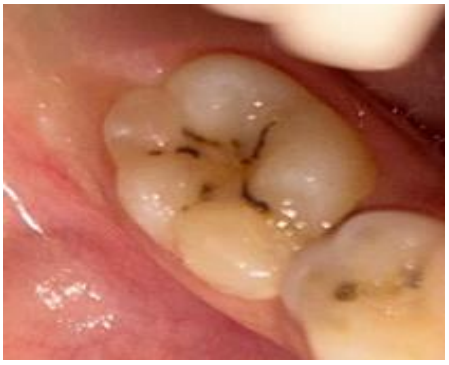

**Figure 3.** Intraoral image of tooth number 46 before treatment

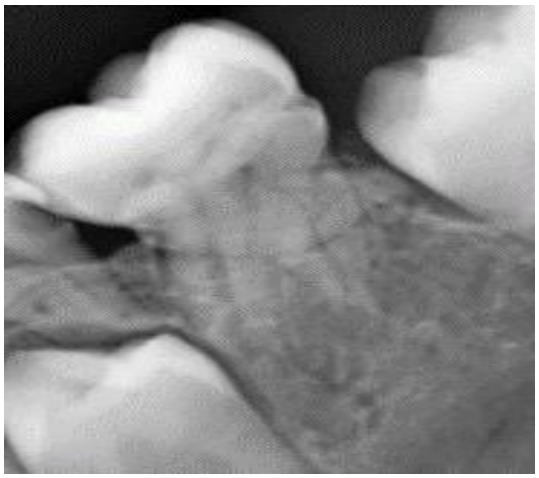

**Figure 4.** Periapical X-ray of tooth number 36.

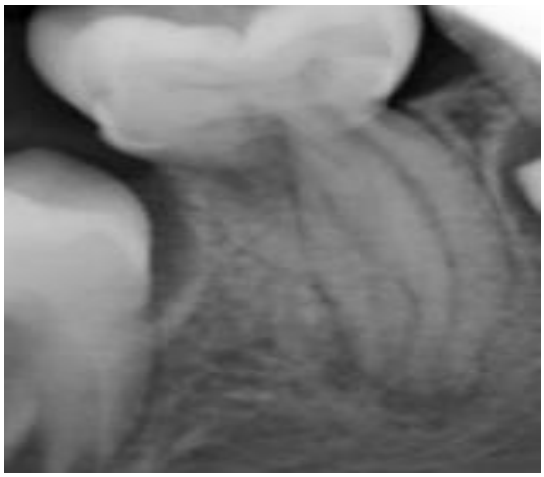

**Figure 5.** Periapical X-ray of tooth number 46.

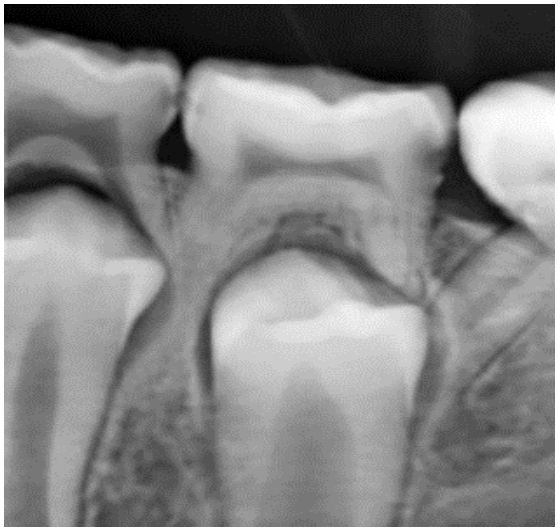

**Figure 6.** Periapical Image of Mandibular Milk 2nd Molar

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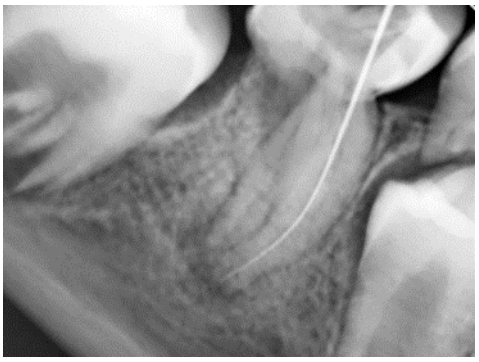

**Figure 7.** File film of tooth number 46.

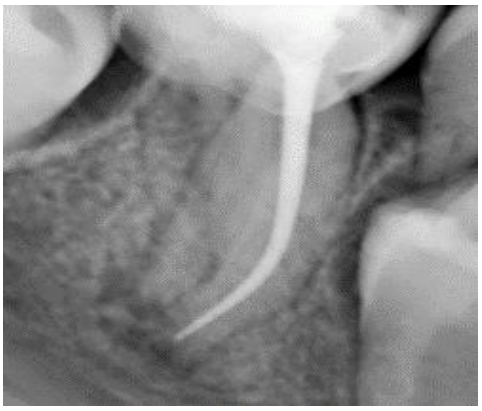

**Figure 8.** Post-treatment periapical image of tooth number 46.

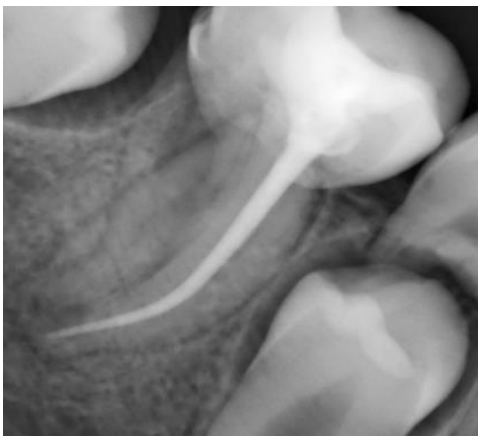

**Figure 9.** 3rd month follow-up periapical image.

## DISCUSSION

Molar-incisor malformation (MIM) or molar root-incisor malformation (MRIM) is a dental anomaly that was first described in the literature in 2014 and can affect molars and maxillary central incisors (6,7).

The prevalence of MIM has not yet been precisely determined and it usually occurs in the first permanent molars, but it can also occur in the second molars, although this is rare (8).

Typical findings of molars with MIM are malformed roots that appear hypoplastic, incomplete or short and narrowed, and crowns that are narrowed from the cervical portion, reduced ceiling-to-floor distance in the pulp chamber, and a cleft appearance of the pulp chamber on radiographs. Similarly, maxillary central teeth may have crowns narrowed towards the cervical part and/or groove-like enamel defects. Molar crowns are not affected and appear clinically normal (6-9).

The etiology of MIM is unknown but has been described to be related to epigenetic mechanisms: A change in gene function and eventual phenotype without a change in DNA sequence (6). Medical conditions occurring in the first two years of life have been associated with this anomaly in root development. Remarkably, a significant proportion of affected patients have a history of neurological systemic disease such as meningitis, spina bifida, seizures, hydrocephalus or idiopathic brain diseases. Other less frequently described health conditions include preterm birth, abdominal tumor detected prenatally, kidney disease, urinary tract infection or staphylococcal infection diagnosed shortly after birth (8). Epigenetic changes resulting from important medical events such as surgery and drug use in the first years of life are also likely to affect the development of MIM (10). On the other hand, four individuals who did not show any disorder at birth or in the neonatal period have been described in the current literature (8).

Since the roots of the first permanent molar begin to form around the age of three, root malformation seems to be related to environmental factors that the patient experiences mostly in early childhood (11).

Propofol, commonly called “milk of anesthesia”, is one of the most popular intravenous anesthetic agents in modern medicine. Propofol has many pharmacologic advantages over other anesthetic agents, including rapid onset of action, short duration of action, and fewer side effects such as postoperative nausea (12).

The fact that propofol has many advantages and is frequently preferred today has led to the questioning of whether it is an ideal agent or not, and thus, researches on its potential harms have been conducted. Especially the

harmful effects of propofol on the developing brain tissue and neurologic system have been investigated in various studies (13-15).

Human brain tissue originates from the neural crista during embryonic development. Along with brain tissue, the formation of mesoderm, head skeleton, facial, trigeminal, and glassopharyngeal nerves, maxillary and mandibular bones, periodontal ligament, dentin tissue and alveolar bones also originate from neural crista. Except for the enamel of ectoderm origin, all other tissues and supporting structures of the tooth are formed with the support of neural crista cells (16).

Özer et al. 2017, the results of his thesis study show that dentin thickness and pulp chamber length are affected due to propofol administration during tooth development. In the findings obtained from histological examinations, it is seen that the predentin layer was affected in all experimental groups, and calcifications were observed in places, unlike the control group. The findings obtained from the study suggest that propofol may be effective on neurons and may affect the development of teeth developing from the same embryologic origin, but the results do not seem to be sufficient to reach a definite judgment (16).

Choi et al. 2022 published in vitro study showed that propofol, which is widely used in dental sedation, may have an inhibitory effect on odontogenic/ osteogenic differentiation of human dental pulp stem cells (17).

Our patient also had a history of surgery for spina bifida when she was 3 years old. Based on all these studies, it can be thought that the propofol taken by the patient during surgery may have caused the malformation of the lower first teeth. In the differential diagnosis of MIM, idiopathic root resorption, regional odontoplasia, dentin dysplasia type 1 and molar incisor hypoplasia (MIH) may be considered (18).

MIM can be diagnosed differently from other diseases showing root malformations. Dentin dysplasia type I is a hereditary disease that can affect the entire dentition, while molar incisor malformation is a non-hereditary disease localized to specific teeth. Regional odontodysplasia and molar incisor malformation are related in that both are non-hereditary and localized to a specific region. However, while regional odontodysplasia exhibits thin enamel, large pulp chambers and affects several adjacent teeth, molar incisor malformation exhibits none of these phenotypes. MIH is similar to MIM in that both are localized to the first permanent molar and maxillary incisor. However, teeth affected by MIH have weakened enamel with normal roots, whereas teeth affected by MIM exhibit normal enamel with abnormal roots (19).

Endodontic treatment is recommended when symptoms such as pain, abscess, periapical lesion and root resorption are present in molar incisor malformation (20). Two case reports of successful endodontic treatment have been reported. In the treatment of teeth with molar incisor malformation, Yue et al. successfully performed endodontic treatment of a thirteen-year-old boy's mandibular left permanent first molar with molar incisor malformation. Byun et al. performed endodontic treatment of a suspected maxillary incisor malformation in a twelve-year-old boy. Even if endodontic treatment was performed, it was reported that the prognosis was poor because the periodontal disease was more difficult to treat (21,22). The long-term prognosis of these cases needs to be determined. Therefore, more research is needed. Based on these studies, root canal treatment may be considered for apical abscesses in teeth with molar incisor malformation and preferably a conservative treatment approach may be chosen.

## CONCLUSION

Molar root-incisor malformation or molar incisor malformation is a rare disorder characterized by permanent first molars, deciduous second molars and maxillary central incisors with a cervical notch, usually with normal crowns and malformed roots. Molar incisor malformation can cause mobility, loss of teeth and thus loss of space, spontaneous pain, periodontal disease and aesthetic problems in the incisors. Early diagnosis with the help of radiographs, including panoramic radiographs, is important to guide the treatment of the affected teeth.

It has been determined that there are very few studies and case reports in the literature on molar incisor malformation. It was concluded that further research on the subject could close this gap and guide physicians in diagnosis and treatment planning.

## Additional Information

*This study was presented as a poster presentation at the 1st Gaziantep University International Dentistry Congress (25-27 October 2024).*

## Conflıct of ınterest

None

**Author contrubutıon** R.M.: Investigation, Validation, Writing-review & editing R.M., ÖP.G.: Data analysis, follow-up case, methodology. R.M.: Data curation, Writing-review & editing, Data Analysis

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