

Oral management of Marfan syndrome: an overview and case report

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Marfan syndrome is an autosomal-dominant genetic disorder that affects connective tissues. Diagnosis is based on genetic history as well as major and minor clinical criteria. This article presents a case of Marfan syndrome, emphasizing the clinical manifestations of the disease, and provides an overview of oral management. Knowledge of the etiopathologic and clinical aspects of this condition is essential to providing dental treatment aimed at improving the quality of life of affected individuals.

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Marfan syndrome was first described by the French pediatrician Antoine Bernard-Jean Marfan in 1896, presenting the case of a 5-year-old girl with abnormalities of the skeletal system, including arms, legs, fingers, and toes that were disproportionately long and thin.¹ The prevalence is estimated at 1 case per 10,000 individuals in the general population, with no predilection for race or sex.² Diagnosis is established according to the Ghent nosology, through a comprehensive assessment that is largely based on a combination of major and minor clinical manifestations in various organ systems as well as family history.³

The pathogenesis of Marfan syndrome has not been fully clarified. However, mutations in the locus of the gene *FBNI* on chromosome 15q21 are believed to exert negative effects, resulting in quantitative and qualitative changes in the glycoprotein fibrillin 1, which may be linked to this syndrome.⁴ Reduced or abnormal fibrillin 1 leads to failure in the homeostasis of elastic fibers and connective tissue weakness.⁵ Marfan syndrome is classified as either type 1 or type 2.⁶ Type 1 is the most common presentation and is caused by mutations in the gene *FBNI*, located on chromosome 15.⁷ Type 2 is less common and is caused by a mutation in the gene that encodes transforming growth factor β receptors 1 and 2.⁸

The orofacial and the general alterations often manifested in patients with Marfan syndrome have negative repercussions on a person's quality of life and psychological outlook.⁹ Social stigmatization may disrupt the ability of these people and their families to successfully adapt to their situation. In this regard, reports addressing the clinical characteristics of this condition and the oral treatment proposed for affected individuals should be highly encouraged.¹⁰ The aim of this article is to present a clinical case of a patient with the syndrome, outlining its clinical manifestations and oral treatment.

Case report

A 12-year-old girl visited the clinic of the Department of Pediatric Dentistry and Orthodontics at the Federal University of Minas Gerais, Belo Horizonte, Brazil, accompanied by her mother. The patient presented with a chief complaint of protrusion of the maxillary anterior teeth. The mother reported that her child had many previous dental appointments in her life.

The physical examination revealed a tall stature, elongated extremities, caved-in breastbone, and scoliosis (Fig 1). Spinal radiography confirmed the presence of scoliosis (Fig 2). The patient also exhibited abnormally long upper limbs and fingers, the latter known as *arachnodactyly* (Fig 3). The patient's history revealed a diagnosis of Marfan syndrome and surgical intervention on 3 different occasions due to cardiovascular and ocular problems as well as for the removal of adenoids. Treatment for scoliosis was nonsurgical (Fig 4).

**GENERAL DENTISTRY
SELF-INSTRUCTION**



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Fig 1. Marfan syndrome in a 12-year-old patient is evidenced by her tall stature and elongated limbs.

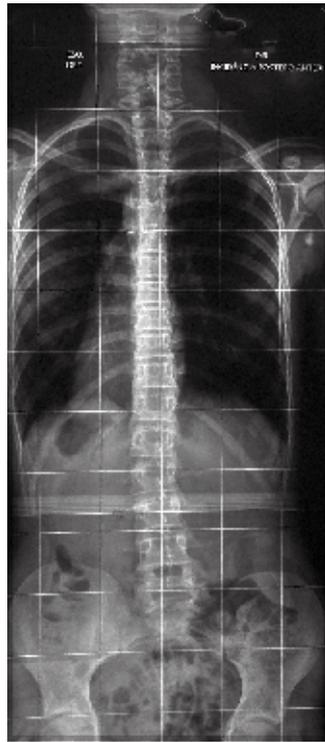


Fig 2. A spinal radiograph confirms scoliosis.



Fig 3. A photograph of the hand reveals arachnodactyly.



Fig 4. The patient has a history of ocular problems. The brace provides nonsurgical treatment of scoliosis.



Fig 5. The patient exhibits dolichocephaly and incompetent lips.



Fig 6. The palate is highly arched.



Fig 7. The maxillary canines are impacted.

The patient had a long, narrow face (dolichocephaly), and her lips were markedly incompetent (Fig 5). The oral examination revealed that the patient was in the permanent dentition phase. The maxillary canines and the maxillary left second premolar were clinically absent. The patient had a highly arched palate, unilateral posterior crossbite, and anterior overbite (Fig 6). No abnormalities were found on the tongue or floor of the mouth. Panoramic radiography revealed that the maxillary canines were impacted (Fig 7).

Prior to the next appointment, the patient's cardiologist was contacted, and prophylactic antibiotics were used to decrease the risk of bacteremia during dental procedures.

The patient was prescribed 1.5 g of amoxicillin to take 1 hour prior to the orthodontic appointments for banding as well as prior to any appointment for periodontal treatment or surgery for tooth extraction. Before orthodontic treatment, the patient was referred to a periodontist to improve her gingival status. Supragingival calculus and plaque were removed using scaling instruments. The scaling roughened the affected tooth surfaces, and a rotating rubber cup with abrasive polishing paste was used to smooth the surfaces. The rubber cup was rotated slowly and applied intermittently to avoid overheating. Linen polishing strips were also



Fig 8. A maxillary midline deviation is present.



Fig 9. The fixed orthodontic appliances are removed after a total treatment time of 30 months.

used to polish the interproximal sites. The need for adequate oral hygiene was stressed and reiterated during subsequent orthodontic appointments.

The first stage of orthodontic treatment involved correction of the unilateral posterior crossbite with rapid maxillary expansion. For this purpose, a Hyrax-type expander was used. The appliance screw was activated with 2 quarter turns, twice a day, for 7 days. The expander was left in situ as a passive retainer for 5 months. During this retention phase, both maxillary canines and the maxillary left second premolar erupted.

The second stage of orthodontic treatment involved therapy with fixed appliances. Alignment and leveling of the maxillary and mandibular arches were completed 6 months after banding and appliance bonding. At this stage, the maxillary right first premolar was extracted to correct the maxillary midline deviation (Fig 8). The patient was referred to an oral surgeon, who investigated her medical and dental history. Clinical examination and periapical radiographs were executed to determine the anatomy involved in the extraction of a maxillary first premolar. The extraction was carried out under local anesthesia. The oral surgeon administered topical anesthesia with benzocaine in gel form, followed by 2 cartridges of prilocaine containing felypressin. Regional anesthesia was obtained via middle superior alveolar and anterior palatine nerve blocks. This procedure was carried out carefully with aspiration during anesthetic administration in order to avoid accidental vascular injection or rapid systemic absorption.

Following administration of anesthesia, the gingival tissue was incised with a scalpel blade, using the gingival line as an incising guide and carrying the incision to the crest of the interdental papillae. The mucoperiosteum was reflected with a periosteal elevator to prevent damage to soft tissues by forceps. Initial luxation was achieved by the use of a straight elevator. The forceps was applied with its long axis parallel to the long axis of the tooth. The first pressure applied was apical force. Pressure was then applied buccolingually, and removal was carried out in the occlusobuccal direction. Following the extraction, the buccal and lingual osseous cortical plates were compressed by squeezing between the thumb and index finger. Sutures were passed through the soft tissues on both sides of the dental ridge and tied over the interdental bone. The patient was then referred back to orthodontic treatment.

Finishing and detailing were achieved with the use of intermaxillary elastics. The appliances were debonded after a total treatment period of 30 months (Fig 9). A maxillary Hawley appliance and a mandibular bonded canine-to-canine retainer were delivered, and appropriate instructions were provided to the patient.

Discussion

Marfan syndrome is an autosomal-dominant genetic disorder of connective tissue that can affect different parts of the body, including the heart, blood vessels, lungs, eyes, bones, and ligaments.¹¹ Cardiovascular disease is the cause of 90% of deaths among patients with this condition.¹² Dilatation of the ascending aorta (with or without aortic regurgitation) is the most common cardiovascular manifestation of Marfan syndrome. Mitral valve prolapse, dilatation of the main pulmonary artery, and calcification of the mitral annulus are also found in affected patients.¹³ Particular attention should be given to aortic status; noninvasive echocardiography is recommended to prevent complications such as aortic dissection or rupture, which may lead to sudden death.¹⁴

On the skeletal level, disproportionate growth of the long bones is the most prominent feature of this syndrome. The bones of the lower and upper limbs and the metacarpals are disproportionately long. The patient's arm span is usually greater than his or her height.¹⁵ Affected individuals also present pectus excavatum (hollowed chest) or pectus carinatum (overgrowth of the ribs). These deformities are progressive during the rapid growth commonly associated with adolescence.^{15,16}

Other typical signs include acetabular protrusion and abnormal curvature of the spine (scoliosis).^{17,18} The former is a deformity of the hip joint in which the acetabulum and femoral head invade the pelvic cavity; the latter is a frequent and potentially severe manifestation of Marfan syndrome, occurring in approximately 62% of affected individuals.^{18,19} Scoliosis in patients with Marfan syndrome is more severe, rigid, and progressive than it is in individuals without this disorder and often requires surgical intervention or at least treatment with a brace.¹⁸

In the present case, the patient presented long arms and fingers. Treatment for the scoliosis was nonsurgical, and the child was fitted for a brace. The mother also reported that the child had undergone surgery for the treatment of mitral valve prolapse and had been under surveillance with echocardiographic follow-up.

Table. Diagnostic features of Marfan syndrome, based on the Ghent criteria.³

System	Major criteria	Minor criteria	System involvement
Skeletal	Pectus carinatum; pectus excavatum; arm span greater than height; wrist and thumb signs; scoliosis; reduced extension at the elbows; medial displacement of the medial malleolus causing pes planus; acetabular protrusion	Pectus excavatum of moderate severity; joint hypermobility; highly arched palate; facial appearance (dolichocephaly, malar hypoplasia, retrognathia)	At least 2 major criteria or 1 major plus 2 minor criteria must be present.
Cardiovascular	Dilatation of the ascending aorta with or without aortic regurgitation; dissection of the ascending aorta	Mitral valve prolapse; dilatation of the main pulmonary artery; calcification of the mitral annulus; dilatation or dissection of the descending thoracic aorta	At least 1 major or 1 minor criterion must be present.
Ocular	Ectopia lentis	Abnormally flat cornea; increased axial length of globe; hypoplastic iris or ciliary muscle causing miosis	At least 2 minor criteria must be present.
Pulmonary	None	Spontaneous pneumothorax or apical blebs	At least 1 minor criterion must be present.
Skin and integument	None	Striae atrophicae or recurrent or incisional hernia	At least 1 minor criterion must be present.
Dura	Lumbosacral dural ectasia	None	At least 1 major criterion must be present.
Family/genetic history	Parent, child, or sibling who meets the aforementioned criteria; presence of mutation in <i>FBNI</i> gene; presence of an inherited haplotype around <i>FBNI</i>	None	At least 1 major criterion must be present.

With respect to orofacial aspects, dolichocephaly, retrognathia, micrognathia, deep palate, and a convex profile are common findings.²⁰ Marfan syndrome also affects the ocular system, as patients may exhibit ectopia lentis (displacement of the crystalline lens), an abnormally flat cornea, and increased axial length of the globe, which produces myopia and is a major cause of retinal detachment. Strabismus (misalignment of the eyes) is also a frequent ocular feature in Marfan syndrome.²¹ The mother in the present case reported that her child had undergone surgery for the correction of retinal detachment at the age of 8 years.

Marfan syndrome also has a number of oral manifestations. Patients with this syndrome are at significantly greater risk for dental caries.^{22,23} Local hypoplastic enamel spots are frequent and may be related to a history of caries in the primary dentition. Root deformity, abnormal pulp shape, and pulpal inclusions are frequent findings. Pulp calcifications and gingival inflammation indices are significantly higher in patients with Marfan syndrome.^{22,23} However, cases of severe periodontal disease are less frequent.²⁴ Supernumerary teeth and severe dental crowding are considered highly unusual oral characteristics in patients with this syndrome.²⁵ On the other hand, an increased prevalence of temporomandibular joint subluxation and signs and symptoms of temporomandibular disorder are to be expected in patients with this disorder.²⁶

Pulmonary and skin/integument systems may also be involved. Affected individuals may present spontaneous pneumothorax, apical blebs, and recurrent or incisional hernias.³

Other symptoms include nephritic syndrome due to glomerular basement membrane alterations, hematologic abnormalities, primary hypogonadism, and alopecia.²⁷

In the present case, the patient had dolichocephaly. The oral examination revealed the absence of dental caries, and the clinical examination indicated normal temporomandibular joints and mandibular movements. However, the patient's gingival status required improvement. Given that individuals with Marfan syndrome show a tendency to present increased gingival inflammation, regular professional prophylaxis of the dentition is advisable to reduce bacterial biofilm and to improve gingival health.²⁴ Dental surveillance has been recommended for patients with Marfan syndrome who have prosthetic heart valves due to the increased risk of endocarditis.^{13,24} The patient in the present case did not exhibit supernumerary teeth, but the panoramic radiograph revealed the presence of impacted teeth.

An *FBNI* mutation analysis is helpful to identify individuals at high risk for Marfan syndrome. However, mutations in this gene have also been found in patients with other diseases.²⁸ The diagnosis of Marfan syndrome is based primarily on clinical features; therefore, a comprehensive clinical evaluation is mandatory before any definite conclusion can be established.²⁹ The Berlin nosology was the first concerted effort to address this issue in 1986.³⁰ The criteria have since been revised, as the Berlin nosology was established prior to any clear notion regarding the cause of this condition, which is not rare and has social, economic, and psychological consequences.³ The

implications of Marfan syndrome are nearly always negative, which underscores the need to avoid both a false-positive and false-negative diagnosis, as failure to take proper precautions can have profound consequences.⁹

The newly revised criteria, known as the *Ghent criteria*, are still based on a combination of major and minor clinical manifestations in different organ systems (Table). The diagnosis of Marfan syndrome is made with the presence of 1 major criterion in the family history and 1 major criterion in an organ system plus involvement of a second organ system. If the family and genetic history is not contributory, the presence of 1 major criterion in 2 different organ systems and the involvement of a third organ system are required.³ The improved health associated with updated treatment modalities, combined with the low life expectancy among individuals with undiagnosed cases, underscores the importance of early diagnosis.^{20,31}

In the case described herein, there was no report of the syndrome in other members of the family. However, the child exhibited features involving 3 different organ systems, thereby meeting the Ghent criteria for diagnosis of Marfan syndrome. The patient presented scoliosis, a highly arched palate, and dolichocephaly (skeletal system). The child also had a prolapsed mitral valve that required surgery (cardiovascular system) as well as retinal detachment that also required surgical correction (ocular system).

A number of disorders present features similar to those of Marfan syndrome. Differential diagnoses include Lujan-Fryns syndrome—an X-linked intellectual disability disorder with marfanoid features—and Beals syndrome, an autosomal-dominant disorder associated with mutation in fibrillin 2 in which joint contractures and ear anomalies are found in addition to a Marfan syndrome–like appearance.³² Another possible diagnosis is the MASS phenotype (mitral valve prolapse, aortic enlargement, skin and skeletal findings), which is similar to Marfan syndrome in that affected individuals present fibrillin 1 mutation and show aortic dilatation, myopia, mitral valve prolapse, skin involvement, and skeletal involvement. However, these features are less pronounced in individuals affected by MASS phenotype than in patients with Marfan syndrome.²⁹ Other connective tissue disorders, such as Stickler syndrome and Ehlers-Danlos syndrome, may also be considered in differential diagnoses due to their overlapping characteristics with Marfan syndrome. Myopia and retinal detachment are features of the former, while skin laxity and easy bruising are prominent in the latter.³²

General dentists should be aware of this information, as it may be helpful for the early diagnosis of Marfan syndrome.³³ Following a precise diagnosis, clinicians should be able to identify any special dental-related considerations of this condition and understand how to treat affected individuals. The aim of the management and treatment of individuals with Marfan syndrome is to improve life expectancy.³¹ The syndrome can be effectively managed if proper care is provided by a multidisciplinary team of professionals. Cardiovascular, ocular, and skeletal monitoring are highly recommended following the definitive diagnosis and after any surgery.¹¹ Such patients also require oral monitoring to improve or maintain gingival health and undergo orthodontic treatment.²⁰ A high standard of oral hygiene must be established prior to orthodontic treatment in patients at risk.

Antibiotic prophylaxis should be used for oral procedures, such as orthodontic banding, tooth extraction, and periodontal treatment.^{34,35} Oral administration of 50 mg/kg of amoxicillin (or 50 mg/kg of intravenous or intramuscular ampicillin for children who are unable to take oral medication) is recommended before surgery. Individuals who are allergic to amoxicillin or ampicillin should take 50 mg/kg of cephalexin or 20 mg/kg of clindamycin. Those patients who are allergic to amoxicillin or ampicillin and unable to take oral medication should be administered 20 mg/kg intravenously or cefazolin/ceftriaxone 50 mg/kg (intravenously or intramuscularly).³⁶

For patients requiring tooth extraction for orthodontic purposes, the clinician should consider an anesthetic containing felypressin, given that the use of epinephrine may cause acceleration of cardiac function.³⁷ The presence of cardiovascular alterations demands careful preoperative evaluation and the use of a skillful anesthetic technique.³⁸ Topical anesthetic may be useful in reducing pain during needle penetration and discomfort while the anesthetic is administered.³⁹ Monitoring of blood pressure and aortic pulse wave velocity is strongly recommended during oral surgery procedures for patients with Marfan syndrome.³⁷

Conclusion

Early diagnosis of Marfan syndrome is essential to ensure adequate therapy and increase the affected individual's life expectancy. Therefore, dentists should be able to identify the features of this condition. Dentists also play an important role in providing adequate care for such individuals. A better understanding of the etiopathogenesis and adequate dental treatment techniques can lead to appropriate therapy decisions for the prevention or correction of oral manifestations.

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Consent

The patient's parent granted permission for publication of full-face photographs.

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