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Maple Syrup Distribution Disease (MSUD) in a Pediatric Patient: Clinical Course of Conservative Management in Two Cases

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ABSTRACT: Maple syrup urine disease (MSUD) is a rare, autosomal recessive metabolic disorder caused by a genetic defect in the metabolism of branched-chain amino acids. This metabolic disorder in children can affect tooth development and increase the prevalence of caries. During dental treatment, the systemic conditions of these patients should be considered, procedures that may create metabolic stress should be avoided, and treatment planning should be undertaken with a multidisciplinary approach. This case report examines conservative dentistry approaches in two pediatric patients diagnosed with MSUD. The study aimed to address the pain, functional, and aesthetic needs of two siblings diagnosed with MSUD, alleviate the adverse effects on gingival health, and treat tooth sensitivity. In both cases, invasive procedures were avoided, and treatments were performed using noninvasive methods whenever possible. Behavior management techniques increased patient compliance, and local anesthesia administration and procedure durations were planned with consideration of metabolic stress factors. Preventive treatments were implemented to prevent premature and unnecessary tooth loss, and patients were invited for follow-up appointments at six-month intervals. The purpose of this case report is to highlight the points to consider during dental treatment in individuals diagnosed with MSUD and to demonstrate the effectiveness of the conservative approach.

KEYWORDS: Maple Syrup Urine Disease, MSUD, conservative management, metabolic disease, pediatric dentistry.

INTRODUCTION

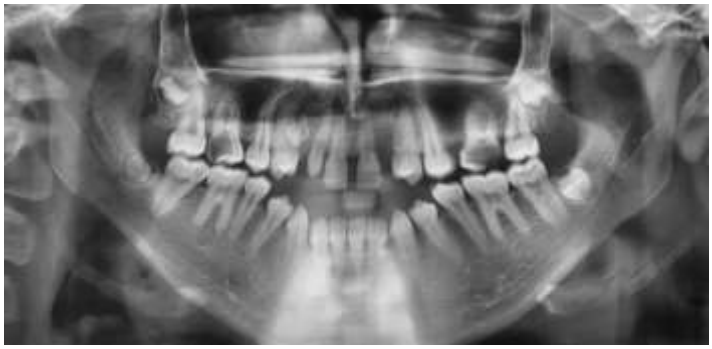
Maple Syrup Urine Disease (MSUD) is a rare autosomal recessive metabolic disorder caused by a deficiency in the α-ketoacid dehydrogenase complex involved in the metabolism of branched-chain amino acids. The disease was first reported in the early 1950s in four siblings with severe ketoacidosis, associated with infantile cerebral edema, seizures, respiratory irregularities, and a strong maple syrup odor in the sweat and urine. In later years, the accumulation of branched-chain amino acids isoleucine, leucine, and valine in the urine was identified (1). MSUD presents with varying degrees of enzyme deficiency and can occur in five forms: severe (classic), moderate, intermittent, thiamine-sensitive, and E3 deficiency (2). MSUD occurs in 1 in 185,000 births worldwide. Higher incidence rates have been reported in populations with high consanguinity. Classic MSUD is the most common and severe form of the disorder. If left untreated, it causes irreversible neurological damage within 7 to 10 days, leading to death within 2 months. Clinical course is directly related to early diagnosis and sustained metabolic balance. Therefore, lifelong protein-restricted nutrition, special amino acid formulas, and metabolic monitoring are essential (3).

From a dentist's perspective, patients diagnosed with MSUD carry a risk for oral and dental health due to many different factors. Studies on MSUD patients have shown a high prevalence of findings such as dental caries, plaque gingivitis, enamel hypoplasia, and jaw morphology anomalies. A study by Ballikaya et al. identified gingival inflammation, caries, and dental anomalies in MSUD patients (4). Because children with MSUD have mental and growth- developmental delays, dental treatments can be performed under general anesthesia. Regular medication intake, fluid replacement, and close blood sugar monitoring are especially important for these patients during the perioperative period (5). Nutrition plays a crucial role in maintaining oral health. In the long term, nutritional changes due to medical conditions in metabolic disorders like MSUD can lead to negative health outcomes, such as essential amino acid deficiencies, obesity, and decreased bone mineral density (6). There are very few studies on MSUD in dentistry. The approach to these patients is not limited to the fight against caries, but also requires a multidimensional approach such as behavioral adaptation and the need for anesthesia.

CASE REPORTS

Two siblings, ages 15 and 13, presented to the Pediatric Dentistry Clinic of Harran University Faculty of Dentistry with toothaches. Clinical and radiological examinations revealed dental caries. Because the older sibling was diagnosed with MSUD late, control of the condition was delayed, leading to developmental delays. The 15-year-old patient had deeper caries and poor oral hygiene than

the younger sibling. Our patient was wheelchair-bound and could communicate with the patient, but he had dental phobia. The patient's body trembled intensely and involuntarily. He had difficulty holding his head steady. General anesthesia was contraindicated. Clinical and radiological examinations of the 15-year-old revealed deep dentinal caries on teeth 16 and 26. Tooth 13 was missing, and an impacted odontoma-like anomaly was observed in that area (Figure 1). Tooth 12 was present in the mouth, but it did not appear anatomically normal. Teeth 22 and 23 were missing, and there were diastemas in the anterior region (Figure 2).



Tooth 16 was treated. Tooth 26 was indicated for extraction, but due to the absence of symptoms, it was monitored. Scaling and polishing were performed, oral hygiene instruction was provided, and preventive treatments were implemented to prevent premature and unnecessary tooth loss. Patients were invited for follow-up appointments at six-month intervals.

Figure 1: Radiographic image of a 15-year-old patient

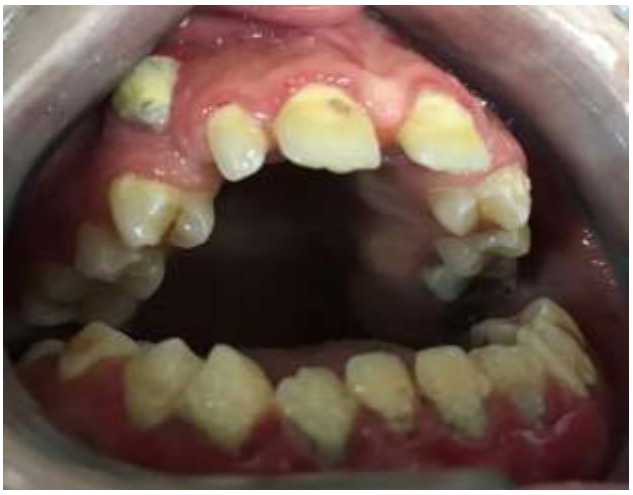


Figure 2: Intraoral view of a 15-year-old patient

A 13-year-old patient was diagnosed with decay and tartar in both primary and permanent teeth, gingivitis, and missing lower central incisors (Figure 3). Conservative treatment was performed on the permanent teeth. Because the primary teeth were asymptomatic, they were retained. Follow-up showed that the primary teeth had fallen out, while the lower permanent teeth had erupted (Figure 4, Figure 5). Scaling and polishing were performed, and preventive treatments were implemented to prevent premature and unnecessary tooth loss. Patients were invited for follow-up appointments at six-month intervals.

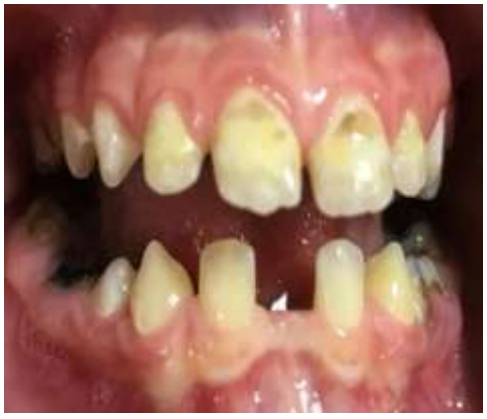


Figure 3: Intraoral view of a 13-year-old patient

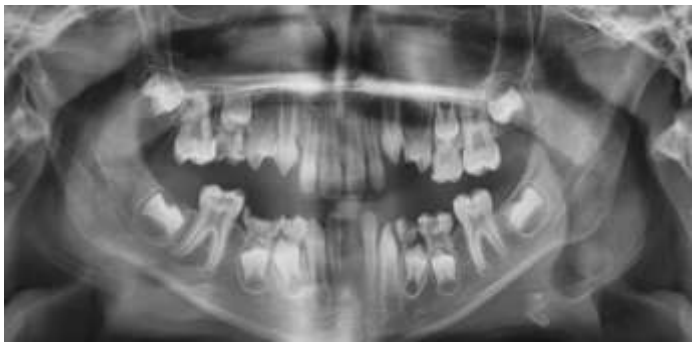


Figure 4: Radiographic image taken before treatment in a 13-year-old patient

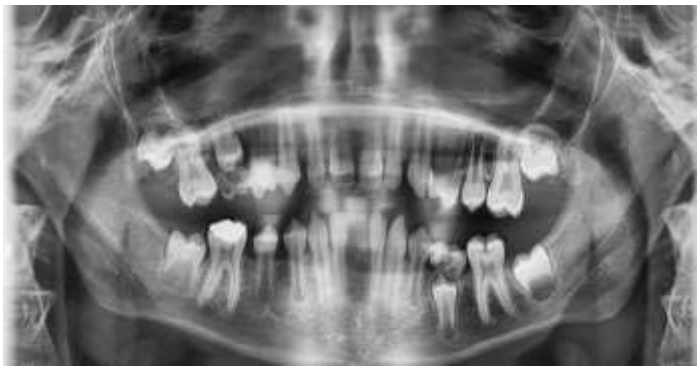


Figure 5: Radiographic image taken after treatment in a 13-year-old patient

DISCUSSION

Maple syrup urine disease (MSUD), a metabolic disease, is caused by a deficiency in the branched-chain α-keto acid dehydrogenase complex, leading to the accumulation of branched- chain amino acids in patients. Early diagnosis and a protein-restricted diet play a crucial role in treatment to prevent the onset of neurological symptoms (7). In the classic form of MSUD, symptoms appear shortly after birth. In untreated newborns, a maple syrup odor can be detected in serum as early as 12–24 hours and in urine as early as 48–72 hours after birth. Early initiation of treatment in newborns diagnosed early plays a critical role in alleviating symptoms (8). In the presented case series, it was noteworthy that the older sibling had a late diagnosis, a delayed initiation of treatment, and a greater degree of both neurological and physiological growth retardation.

In untreated MSUD, metabolic disturbances lead to cerebral edema, affecting neurotransmitter synthesis and brain nitrogen metabolism. These effects are primarily due to leucine accumulation. Long-term management of MSUD patients includes dietary leucine restriction through metabolic formulas and low-protein foods (9). The goal of dietary therapy in patients with innate metabolic syndrome is to limit the offending metabolite while maintaining normal growth and development. The offending metabolite is significantly reduced and then reintroduced in small amounts once blood levels return to the normal range. This treatment is necessary throughout infancy, childhood, and adulthood and requires careful lifelong monitoring of micronutrient and macronutrient intake (10). In this study, caries prevalence was evident in both patients on a carbohydrate-rich diet. The high risk of caries was minimized by providing treatment and oral hygiene instruction.

Little is known about the psychosocial impact on individuals diagnosed with MSUD. Lifelong dietary management challenges, social isolation from peers, family stress, and burnout necessitate a collaborative, multidisciplinary approach to treatment for these patients (11). Another study reported that approximately 75% of MSUD patients had a poor quality of life, while only 25% had a good quality of life (12). In the present study, patients were reassured by behavioral guidance before dental procedures, treatment sessions were short, and dental phobia was minimized with multiple sessions, resulting in successful outcomes.

Metabolic diseases present significant challenges for pediatric dentists. In addition to orofacial features, comorbidities, contraindications to certain medications, dietary changes, and behavioral and developmental issues contribute to limited access to oral health care. For pediatric dentists, the focus should be on intensive oral hygiene education, fluoride therapy, fissure sealants, and regular dental checkups. Any restorative intervention will minimize future recurring infections. In cases of irreversible pulpitis, extractions may be the preferred treatment option over pulp therapy to prevent the risk of recurring infections. In addition to dietary changes that may accompany amino acid metabolism disorders, phenylketonuria and alkaptonuria should be specifically considered by pediatric dentists (13). In this study, in addition to dental treatments, preventive measures such as fluoride applications and fissure sealants eliminated potential foci of future infection, improving the patient's nutrition and quality of life.

CONCLUSION

Maple syrup urine disease (MSUD) reduces quality of life through symptoms such as tooth sensitivity, aesthetic and functional impairments. Therefore, preventive dental care is crucial for preventing premature tooth loss. Conservative dental treatments are beneficial for the patient's social and psychological well-being, and are acceptable to the patient.

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