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CASE REPORT

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Multiple dental caries management of a 5-year-old child with MIS-C: a case report

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Abstract

The rare hyper-inflammatory condition known as "multisystem inflammatory syndrome in children (MIS-C)" develops after a COVID-19 infection. Providing dental treatment for patients with MIS-C can be very challenging due to the immunocompromised condition found in these patients leading to rapid progression of other infections, including dental caries. Currently, there is a lack of information regarding the dental management of patients with MIS-C. This case report presents the multiple dental caries management in a 5-year-old Cambodian boy with MIS-C in a dental chair unit, without general anesthesia. Despite the challenges this case presented, *i.e.*, the patient's age, hyper-inflammatory condition due to MIS-C, taking several medications, multiple caries lesions, and the language barrier for behavior management, we were able to meet this patient's needs. The patient's dental and physical health were found to be satisfactorily stable with no complications. At the 6-month recall, his overall oral health had dramatically improved. Careful treatment planning along with a multidisciplinary approach is highly recommended in such cases. The important roles of dentists are not only to treat oral infection, but also to approach patients holistically because the body systems are all connected.

Keywords

Case report; Dental management; MIS-C; Oral manifestations

1. Introduction

Children with COVID-19 have been reported to have a broad spectrum of characteristics ranging from asymptomatic infection to severe respiratory tract disorders that can potentially transmit severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) to others [1]. The serious COVID-19 symptoms found in children may progress to multiple organ disorders and death. In April 2020, the United States and many countries in Europe, including the United Kingdom, Italy, France, and Switzerland, have reported similar findings in children and young adults with severe COVID-19 infection. These findings included multiple organ involvement that required hospitalization in intensive care units. In May 2020, this condition was named multisystem inflammatory syndrome in children (MIS-C) by the Centers for Disease Control and Prevention [2].

MIS-C is a rare complication found in children in the current COVID-19 situation. The incidence of MIS-C is typically co-related with the incidence of SARS-CoV-2 infection in children. The demographic characteristics of children with MIS-C (median age ranged from 7–10 years old) vary among different races and ethnicities. Studies have found that Black and Hispanic children have a higher occurrence of MIS-C than white and other races [3, 4]. Although some studies have found conflicting results based on sex, other reports indicated a higher MIS-C incidence in males, similar to Kawasaki disease [5, 6]. The exact pathogenesis of MIS-C has not been determined; however, it may be due to a post-infection SARS-CoV-2 induced hyperimmune response from cytokine release leading to multiorgan inflammation. However, the common characteristics found in pediatric patients with MIS-C are immunocompromised conditions that could be from an over-reactive immune response to SAR-COV-2 and the effects of medications, including immunotherapy. Moreover, any additional infection including infection from dental caries, often progresses rapidly, leading to a more severe situation.

Currently, there are limited reports and evidence-based literature regarding the dental treatment approaches in these uncommon patients. The purpose of this report was to present the dental management of a 5-year-old patient with multiple dental caries and MIS-C. Furthermore, the dental considerations involved in the clinical manifestations, medications and therapeutic approaches for this hospitalized young patient are discussed.

2. Case report

A 5-year-old Cambodian boy was referred from the pediatric cardiological department at the Queen Sirikit National Insti-

tute of Child Health (QSNICH) to the dental department for the appropriate treatment of multiple dental caries that were suspected to be due to another source of infection.

The patient had been hospitalized for treatment of MIS-C and multiple other complications. He was first transferred from a hospital in a province with a high rate of COVID-19 spread (located 240 km from QSNICH) to the pediatric intensive care unit at QSNICH with endotracheal intubation. His medical history included a history of a high fever for 6 d, severe diarrhea, vomiting, skin rash and dyspnea. His serological tests demonstrated positive SARS-CoV-2 immunoglobulin G (IgG) and negative immunoglobulin M (IgM) antibodies, indicating that the patient was unlikely to spread COVID-19.

During his stay at the hospital, the patient experienced severe acute gastroenteritis, acute respiratory failure, and cardiomyopathy with congestive heart failure, including conjunctivitis. Furthermore, his laboratory findings confirmed elevated levels of inflammatory markers, comprising C-reactive protein, erythrocyte sedimentation rate, procalcitonin, D-dimer, ferritin and lactate dehydrogenase (LDH) (Table 1). He received 2 doses of intravenous immunoglobulin (IVIG) (2 g/kg/dose), methylprednisolone (30 mg/kg/day), enoxaparin (0.5 mg/kg/dose), and inotropic drugs, *i.e.*, dobutamine, adrenaline, dopamine, milrinone, and fluconazole. Moreover, during treatment, the patient was unable to talk, but could understand Khmer language and follow instructions. Therefore, he was referred to a neurological clinic to rule out Broca's aphasia and received supportive treatment along with vitamins. On his 8th day in the hospital, his myocarditis and other clinical symptoms had improved and he was extubated. The patient was also prescribed methylprednisolone and antibiotics, *i.e.*, vancomycin and ceftriaxone. He was on acetylsalicylic acid (ASA) (81 mg) for thromboprophylaxis and several medications for treating myocarditis comprising captopril, digoxin, furosemide, and spironolactone. After 15 d in the hospital, the patient's overall health conditions were stable. The pediatric cardiologist decided to refer him to the dental department for the appropriate treatment of multiple caries lesions. This patient was in a challenging condition because:

(1) He presented with very poor oral health and hygiene.

(2) He had been on long-term high dose of steroids (IV methylprednisolone pulse, an effective therapeutic agent for hospitalized severe COVID-19 patients at the pulmonary phase) for a long time that could lead to immunodeficiency, thus be prone to infection.

(3) Poor ventricular contraction was observed.

His intraoral examination revealed very poor oral hygiene with multiple dental caries, including unrestorable caries on teeth 74, 75 (Fig. 1). He had tooth 85 removed at a dental clinic several months ago due to acute pain. Radiographic examination also revealed periapical pathology at teeth 74, 75 (Fig. 2). In addition, oral manifestations, *i.e.*, stomatitis and mucositis as erythematous mucosa with dry, redness and cracked lips were present (Fig. 3). His coagulation tests (prothrombin time (PT) and international normalized ratio (INR)) were normal, therefore, tooth extraction could be performed with no additional management. The dental team then planned for extracting teeth 74, 75, a stainless steel crown on tooth 84 and glass ionomer cement restorations on tooth 83 and all lesions on the upper teeth. No prophylactic antibiotics were needed in this case. The dental procedures were performed using atraumatic restorative technique in a dental chair unit under local anesthesia and rubber dam application.

The preventive plans for this patient included oral hygiene instruction (hands-on training with his mother), dietary counseling and fluoride therapy. On the day after tooth 84 was treated, an irregularly shaped ulcer at the attached gingiva of the tooth was observed. Therefore, 0.12% chlorhexidine gluconate was prescribed to be applied daily using cotton swabs. At the follow-up visit, normal wound healing at the attached gingiva of tooth 84 was observed (Fig. 4).

At every dental visit, his health condition was found to be stable with no complications. The patient was appointed for dental recall 1 month after discharge following scheduled appointments for neurological, infectious disease, and cardiological follow-ups due to his remote hometown. Subsequently, dental recall followed his cardiological appointments at the 3 and 6 months follow-up visits. At the 6-month follow-up visit, the overall oral health of the patient had dramatically improved. The patient was examined to evaluate the space and dental occlusion after the extraction of teeth 74, 75 and 85. Additionally, we informed the parents about the plan to place space maintainers after the premature loss of primary molars but this was denied due to financial reason. At the 6-month follow-up visit, the patient had space deficiencies due to the premature extraction of teeth 74, 75 and 85. Future space regaining by orthodontic treatment was then planned (Figs. 5,6).

TABLE 1. Laboratory findings showed elevated inflammatory markers.

Markers	Normal value	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7
Erythrocyte sedimentation rate (ESR)	(<40 mm/h)	54.00	17.00	13.00	10.00	8.00	10.00	4.00
C-reactive protein (CRP)	(<50 mg/L)	263.00	181.00	122.00	87.40	43.00	29.00	16.00
Procalcitonin	(<0.5 ng/mL)	32.17	-	73.00	39.41	20.85	8.90	-
D-dimer	(<500 ng/mL)	4608.34	3078.00	2924.00	-	-	-	9691.00
Ferritin	(<500 mcg/L)	2269.00	-	-	-	-	-	-
lactate dehydrogenase (LDH)	(140–280 U/L)	486.00						

FIGURE 1. Initial intraoral clinical examination showed multiple dental caries with unrestorable of primary mandibular left first and second molar.

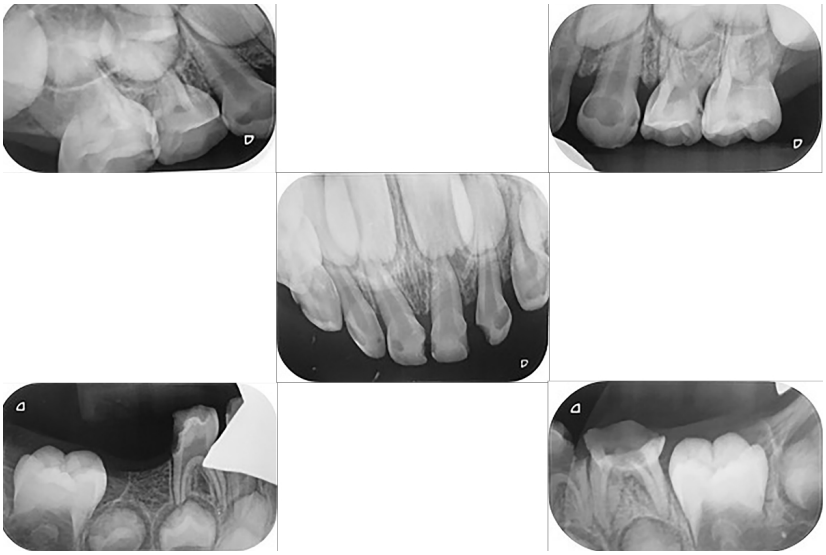

FIGURE 2. Initial radiographic images.

FIGURE 3. Oral manifestations presented with stomatitis and mucositis, erythema lips and mucosa, dry and cracked lips.

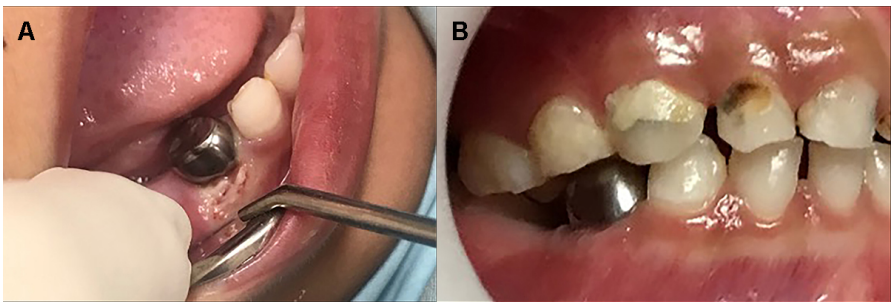

FIGURE 4. Localised gingival ulceration. (A) Oral ulceration appeared as a yellowish white pseudomembrane covering at attached gingiva of primary mandibular right first molar. (B) After 3 months follow up, the ulcer had spontaneously resolved.

FIGURE 5. 6 months follow up intraoral examination.

FIGURE 6. 6 months follow up radiographic images.

3. Discussion

MIS-C is a rare emerging hyperimmune condition associated with post-SARS-CoV-2 infection. This multiorgan inflammatory syndrome is usually found 2–6 weeks after being infected with the virus.

According to the definition given by the United States Centers for Disease Control [2], the signs and symptoms observed in our case fulfilled almost all the criteria. Thus, the patient was diagnosed with MIS-C.

MIS-C treatment is similar to that for Kawasaki disease, in which IVIG is used as the first-line drug and is followed by corticosteroids and other biologic agents, such as cytokines and monoclonal antibodies [7]. In this case, the patient received intensive treatment and received a combination of IVIG and corticosteroids to reduce the number of coronary abnormalities. Although the adverse reactions of IVIG treatment that could cause periodontal diseases are rare, an oral evaluation of the periodontium should be performed.

Dental management in patients with MIS-C, as a part of a multidisciplinary approach, plays an important role in their comprehensive health care. The dental treatment plan should include the patients' present medical status, medications, including side effects and adverse drug interactions; oral health status, timing of treatment, and patient considerations during dental treatment. Consultation with the patient's cardiologist and infectious disease specialists helped assure that the plan was safe and appropriate. Our consultation with the cardiologist revealed that the patient had cardiac involvement and an immunocompromised condition. However, we agreed not to prescribe any additional antibiotic prophylaxis prior to invasive dental procedures because he had already received an adequate level of vancomycin and ceftriaxone during the MIS-C treatment. During treatment, the use of local anesthesia containing epinephrine should not exceed 0.04 mg (approximately 2 carpules) of 2% mepivacaine with 1:100,000 epinephrine in patients with cardiomyopathy [8]. This applied to our patient, who was prescribed digoxin to treat heart failure. It is prudent to not use a drug containing epinephrine because it may lead to cardiac arrhythmia [9] or other administered drugs, including captopril, ceftriaxone and fluconazole may cause unusual bleeding and acute renal failure [10, 11]. Furthermore epinephrine should not be used in combination with vancomycin, which occasionally induces severe asymptomatic immune thrombocytopenia that results in severe bleeding [12]. However, dentists should be aware that patients with MIS-C typically take ASA to reduce the risk of thrombosis as a post-operative bleeding precaution. The side effects of ASA can be controlled with appropriate local hemostatic measures. However, similar to other situations, for minor dental procedures, patients can continue taking ASA [13]. In this case, the patient previously received enoxaparin, a low molecular weight heparin used for thrombosis prophylaxis, which was stopped 6 d before dental treatment. Thus, this patient had no

increased bleeding risk.

Dental management and oral hygiene improvement were a top prioity in treating this case because his health condition was prone to infection. Poor oral hygiene and multiple dental cavities were considered the main sources of infection that could lead to a more severe condition in other organs, such as the cardiovascular and respiratory systems, which may result in pneumonia and other severe infections. Although the laboratory results indicated that the patient was unlikely to spread the virus to others, universal precautions along with atraumatic technique were strictly applied. Moreover, during the COVID-19 pandemic, non-aerosol generating dental procedures and a minimal invasive approach were highly recommended and the aim of the patient's dental treatment was to control the caries and reduce the infection. Therefore, the dental techniques used in this case included the modified atraumatic restorative technique (ART) using a spoon excavator and a slow speed handpiece under local anesthesia and rubber dam application to reduce cross infection. The treatments were done in a dental chair and the treatment time was reduced due to the patient's compromised conditions and uncooperative behavior due to the language barrier. To achieve this, the treatment was divided into 4 quadrants, 1 quadrant per visit.

Another precaution that should be taken into consideration is that steroid therapy is associated with increased susceptibility to infection and delayed wound healing. In this case, the patient had been on steroids for less than 3 weeks and the dental treatment provided was considered minor surgery, therefore, no corticosteroid supplementation was needed [14]. However, we closely monitored the oral wound healing and infection after extraction. At the 6-month recall, the first mandibular permanent molars were fully erupted, however, there was a meaningful space loss after extracting teeth 74, 75 and 85. Space maintainer placement was not performed due to financial problems and the remote location of his hometown. However, we will continue to recall the patient every 6 months and plan to start interceptive orthodontic treatment when the patient is ready.

Oral manifestations have been identified as one of the most frequent clinical symptoms of MIS-C cases. Many studies have reported that patients with MIS-C and Kawasaki disease usually present with hyperemia mucous membranes, erythema, dry/fissured/cracked/swollen lips and tongue with erythematous papillae hypertrophy that progressed to strawberry tongue. These oral alterations are typically self-limiting. Remission usually occurs after systemic treatment with IVIG and general support treatment [15]. In our case report, the oral findings, such as stomatitis, mucositis, erythematous lips and mucosa, and dry and cracked lips concurred with those reported in previous studies [15, 16]. These lesions can be also induced by many drugs, such as ceftriazone, fluconazole, and captopril [17, 18]. Additionally, one of the oral findings in this case was an acute irregularly shaped ulcer at the buccal attached gingiva of the primary mandibular right first molar area. This finding is similar to previous reports stating that the oral findings in MIS-C cases included blisters and sore-like ulcers [15, 19]. In general, oral ulcerations are self-limiting and resolve within 3 weeks. However, in the case of severe ulcerations that do not self-resolve, further differential diagnosis with adjunctive microscopic evaluation may be required to identify the etiology of the ulceration. The results can vary from a common infection, an immune-related lesion, traumatic ulceration, or other causes, including drug-induced oral ulcers from taking ASA, captopril, or fluconazole. More importantly, captopril can delay healing [18, 20]. In this case, we only provided supportive treatment and observation until the lesion recovered. Unfortunately, the final diagnosis of this ulcer and its cause were not investigated. However, awareness of the patient's administered drugs, which can induce oral adverse effects, helped give us better understanding of the etiology of his oral lesions and to manage these complications during dental treatment.

Early identification of these notable oral characteristics of MIS-C is very helpful for further diagnosis. Dentists should be able to identify oral lesions and provide the appropriate management for patients with confirmed MIS-C. These oral lesions are typically self-limiting. Remission usually occurs after systemic treatment with IVIG and general support treatments, including lip moisturizers, mouth rinse, and topical anesthetics. Furthermore, dental preventive care and maintenance of good oral health are considered highly important.

4. Conclusions

In the present case, we provided successful dental treatments and improved our patient's dental hygiene, thus decreasing the risk of more life threatening conditions. However, providing dental care for patients with MIS-C can be very challenging due to the life-threatening condition of the patients. Extra care and effort are needed to provide safe and successful treatment. Understanding the complicated health conditions, drug complications, early detection of oral manifestations, careful treatment planning, and appropriate holistically individualized management, together with a multidisciplinary approach in pediatric medically compromised patients with MIS-C are required.

AVAILABILITY OF DATA AND MATERIALS

Not applicable.

AUTHOR CONTRIBUTIONS

PT and KoP—take care of the patient. KrP—responsible for the drafting of the article. JK—supervised the report. Final approval of the version for completed submission and editorial changes was agreed upon by all authors.

ETHICS APPROVAL AND CONSENT TO PARTICIPATE

This study was approved by The Office of Research Ethics, Queen Sirikit National Institute of Child Health (REC.008/2565). Informed consent signed by the parent of the patient was obtained.

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CONFLICT OF INTEREST

The authors declare no conflict of interest.

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