

## Treatment of Fissure Caries of Children with Severe Rheumatic Diseases with Difficulty in Opening the Mouth

### Abstract

**Background:** Pediatric dentists face difficulties in treating tooth decay of children with difficulty in opening the mouth. This is especially true, as the main disease is accompanied by such symptoms as arthritis, osteoarthritis, myositis, myalgia, sclerosis, and oral atrophy. **Aim:** The aim was to increase the level of treatment of fissure tooth decay for children with rheumatic diseases, using the silicone key method (SKM). **Materials and Methods:** A dental examination of 82 children was carried out, with diagnoses: systemic lupus erythematosus, juvenile systemic scleroderma, juvenile dermatomyositis, and juvenile rheumatoid arthritis. Evaluation of the intensity of caries using indices: decayed, missing, and filled teeth (DMFT)(average). Assessment and measurement of the degree of mouth opening (MMO) by Sh. M. Batashvili. The SKM was used to treat fissure tooth decay. **Results:** During the dental examination of the oral cavity of all children with RD, multiple caries lesions were found. In the first age group of index indicators (DMFT) (on average) - 4.88, in the second age group DMFT (on average) - 7.58 - these values corresponded to high scores for the degree of dental caries, which requires frequent appointment to the dentist. Oral hygiene of children with difficult opening of the mouth is unsatisfactory, which leads to a rapid increase of caries. Restriction of mouth opening <4 mm was found in 57 children with RD (69, 51%) that made it difficult to treat caries. **Conclusion:** Using SKM will improve the quality of caries treatment and provide a stable result of treatment in patients with difficulty opening the mouth in severe somatic pathologies.

**Keywords:** Dental caries, direct restoration, maximum mouth opening, pediatric dentistry, rheumatic diseases

### Introduction

The research of the interrelation of dental pathology and lesion of internal organs and systems of children with rheumatic diseases, and with regard to the growth of this pathology, remains relevant.<sup>[1-3]</sup>

Rheumatic diseases (RD) are severe, immunoaggressive, chronic, rapidly progressing diseases requiring lifelong treatment, leading to the early development of disability.<sup>[2-5]</sup> Damage of joint caused by prolonged changes in the immune system, chronic synovial infection, and inflammation is a major problem in dental practice.<sup>[6,7]</sup> Myositis of the masticatory and facial muscles [Figure 1], arthritis and arthrosis of the temporomandibular joint, [Figure 2a, b], atrophy and sclerosis of the circular muscle of the mouth, with the formation of a microstoma [Figure 3a, b] - these disorders (pathologies) lead to pain in

opening the mouth. Therefore, it is difficult for a dentist to carry out dental treatment, especially in children.<sup>[1,3,4,8-10]</sup> Maximum mouth opening (MMO) is used as a clinical method and marker of chewing pathology. This index depends on age, gender, height, and the presence of somatic pathology. Thus, this index differs in children with rheumatic diseases.<sup>[11,12]</sup> In this group of children, both the frequency and intensity of the carious process are increased, which is associated with the constant use of drugs and negatively affects the local immunity of the oral cavity.<sup>[13,14]</sup> Furthermore, the low level of oral hygiene affects the severity of caries too.<sup>[15]</sup> However, it must be noted, that this is due to a combination of factors such as effects of the disease on the growth of the jaw and masticatory function, it is especially difficult to perform oral hygiene when the joints of the upper limbs are involved, and this can be the reason of a bad hygienist.<sup>[16]</sup> Often, caries treatment requires two visits. Such frequent and

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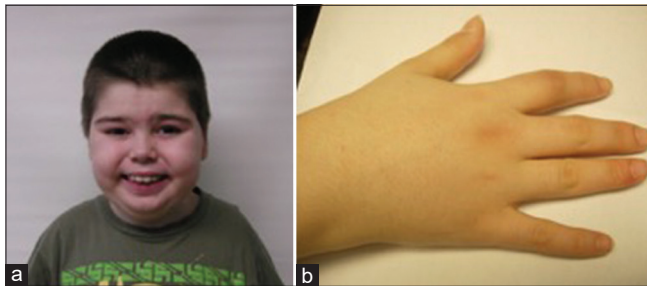
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**Figure 1:** Ten-year-old child. Juvenile dermatomyositis. Paraorbital erythema, severe swelling, and flushing of the face. Acute myositis of the masticatory and facial muscles



**Figure 2:** Twelve-year-old child, juvenile systemic scleroderma. (a) Atrophy and sclerosis of the circular muscles of the mouth. (b) Difficulty opening the mouth, the formation of a microstomy



**Figure 3:** Eleven-year-old child with a diagnosis of: (a) Juvenile rheumatoid arthritis (articular-visceral form), affection of the temporomandibular joint, limited opening of the mouth. (b) Arthritis and deformity of the hand joints

long-term visits can worsen the psychological status of children with rheumatic diseases and lead to complications of the underlying disease.<sup>[17,18]</sup> Based on this, it is necessary to reduce the number of visits and optimize assistance for such children. As a solution to this problem, we suggest using a silicone key method (SKM). The SKM is a direct composite restoration that restores the anatomical shape of the tooth using a silicone impression.<sup>[19]</sup> This SKM is the fastest, most accurate, effective method of restoration, which is especially important and necessary for the treatment of caries of children with rheumatic diseases.<sup>[20]</sup> It is important to note that the SKM allows you to achieve

an exact anatomical shape of the tooth, which will help in the formation of the correct bite of the child and reduce the risks of possible complications of joint diseases. Therefore, the actual problem of an effective and gentle method of caries treatment in this group of children is relevant today.

### Purpose of the research

To increase the level of caries treatment of children with difficulty opening the mouth in case of severe rheumatologic pathology using the silicone key technique.

Objectives of the study:

- Conduct a complex dental examination of children with severe rheumatologic pathology
- Determine the intensity of caries and the level of hygiene of the oral cavity with difficulty opening the mouth
- Measure and evaluate the degree of mouth opening of children with rheumatologic pathology
- Develop and implement a caries treatment method using the SKM, with difficulty opening the mouth.

### Materials and Methods

#### Ethical approval

Registration number and name of trial registry: The Local Ethics Committee of FSAEI of HE I. M. Sechenov First Moscow State Medical University of the Ministry of Health of the Russian Federation (Sechenov University). Protocol number 16-19. The study procedure was according to the World Medical Association Declaration of Helsinki.

#### Study design

We have carried out a dental examination and treatment of 82 children who were hospitalized in the Department of Rheumatology of the I. M. Sechenov First Moscow State Medical University, aged 6–17 years. Thirty-two of them were diagnosed with juvenile rheumatoid arthritis, 25 with juvenile systemic scleroderma, 6 with juvenile spondylarthritis, 8 with juvenile dermatomyositis, and 11 with systemic lupus erythematosus. Children were divided into two age groups: Group I – from 6 to 12 years, Group II – from 13 to 17 years [Table 1].

We defined the following criteria for the inclusion and exclusion of patients to the research.

Criteria for inclusion of patients to the research:

1. Written informed consent of the patients participating in such research
2. Aged between 6 and 17 years
3. Male and female
4. Fissure caries in permanent teeth
5. Patients with rheumatic diseases.

Criteria for the exclusion of patients from the research:

1. Patients over the age of 17
2. Patients under the age of 5

3. Caries in primary teeth
4. Caries in permanent teeth but not in fissures
5. Patients for other somatic pathologies.

Other criteria for exclusion of patients from the research:

1. The refusal of a patient to participate in the research
2. Patients' failure to comply with medical procedures and doctor's recommendations.

During the dental examination, we used the following research methods: collecting anamnesis of life and disease according to the patient's medical history data:

- Clinical examination of the oral cavity
- Evaluation of the intensity of caries using indices: decayed, missing, and filled teeth (DMFT) (average)
- Evaluation of the level of oral hygiene using simplified oral hygiene index (OHI-S)
- Assessment and measurement of the degree of mouth opening (Sh. M. Batashvili, 2010).<sup>[8]</sup> The measurement was performed with an orthodontic ruler or caliper. There were 3° of mouth opening. At Grade 1, the opening of the mouth is weakly limited and is possible within 3–4 cm between the cutting surfaces of the upper and lower central teeth; with 2°, it was noted that mouth opening was limited to 2–2.5 cm; at Grade 3, the mouth opened <1–1.5 cm. We also considered the index MMO, according to which the opening of the mouth in healthy children is 40–50 mm.<sup>[21]</sup>

For the restoration of the carious cavity in children with difficulty opening the mouth, we used the SKM.<sup>[22]</sup> It consisted of the following stages.

#### First stage

Before preparation, a silicone block was formed using a dental impression mass, which should be classified as a type of vulcanization to the "C-silicones" class; its advantage is in sufficient accuracy, low shrinkage, elasticity, and the possibility of disinfection. A rectangular block of this size was formed from the impression mass [Figure 4a and b] so that it captured two adjacent teeth, and a silicone mini impression was removed. Within 2 minutes, an occlusal impression or "silicone key" is taken [Figure 5]. This manipulation did not require a wide opening of the constrained mouth, so children do not fill pain.

#### Second stage

Treatment of caries was in the following manipulations and had a number of features:

- Anesthesia. For anesthesia, the drug was used on the basis of articaine, with a small number of vasoconstrictors, as this group of children, due to the prolonged use of glucocorticosteroids, there is a dysfunction of the adrenal cortex
- The odontopreparation of the carious cavity in the teeth with unformed roots was performed carefully and sparingly
- To control the quality of the preparation, Caries Marker ("Voco" company) and the final sensing of the carious cavity were used
- For the drug treatment of the carious cavity, 2% chlorhexidine gluconate was used.

#### Third stage

Isolation of the carious cavity, for this purpose, used glass-insulating gasket material, which significantly reduced the risk of recurrence of caries and pulpitis.

#### Fourth stage

Etching enamel and applying adhesive. To reduce the time of manipulation, we used the 7<sup>th</sup> generation self-etch adhesive "U-Bond," reducing the time for processing with a separate etch material, primer, and bond.

#### Fifth stage

Restoration of the carious cavity made of a light-cured composite material. The entire portion of the composite is injected into the cavity, the "silicone key" is pressed out and illuminated with an ultraviolet lamp for 20 seconds [Figure 6a-c].

#### Sixth stage

After checking occlusion, finish polishing using discs, rubber bands.

### Results

Dental examination of the oral cavity of all children with severe rheumatologic pathology revealed multiple lesions of the teeth with caries. In the I group ( $n = 39$ ) the scores of the index (DMFT) (on average) were - 4.88 points, while in the II group ( $n = 43$ ) the DMFT index (on average) was 7.58, - these values corresponded high level of dental caries. We also noted that 45 (%) of children aged 6–7 years have affection of the first permanent fissures, and 32 (%) of children aged 12–13 years have their fissures of

**Table 1: The distribution of subjects by nosology and age**

| Age  | I group (from 6 to 12 years) | II group (From 13 to 17 years) |
|--|------------------------------|--------------------------------|
| <b>Diagnosis</b>                               | <b>n=39</b>                  | <b>n=43</b>                    |
| Juvenile rheumatoid arthritis (JRA) ( $n=32$ ) | $n=15$                       | $n=17$                         |
| Juvenile systemic scleroderma (JSS) ( $n=25$ ) | $n=9$                        | 16                             |
| Juvenile spondyloarthritis (JS) ( $n=6$ )      | $n=5$                        | $n=1$                          |
| Juvenile dermatomyositis (JD) ( $n=8$ )        | $n=6$                        | $n=2$                          |
| Systemic lupus erythematosus (SLE) ( $n=11$ )  | $n=4$                        | $n=7$                          |



Figure 4: (a and b) Formation of an impression unit. Mixing base material and catalyst



Figure 5: Spin the silicone key

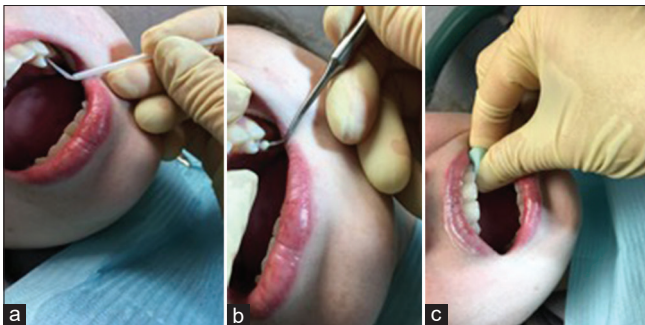


Figure 6: (a-c) Restoration of the carious cavity with a light-cured composite material, using a previously made "Silicone key"

the second molars affected. When assessing the level of hygiene, we found that in all age groups, OHI-S is bad and very bad, which is probably due to difficulties, pain, and stiffness when opening the mouth.

While assessing and measuring the degree of mouth opening (MMO) by Sh. M. Batashvili we received following data- the opening of the mouth was 1–1.5 cm (Grade 3) and such score was among 10 children (12.19%) (with juvenile

systemic scleroderma, with juvenile rheumatoid arthritis, with juvenile dermatomyositis), Stage II- restriction of mouth opening in the range of 2–2.5 cm in 19 children (23.17%) (with juvenile systemic scleroderma, with juvenile rheumatoid arthritis, with juvenile dermatomyositis, with systemic lupus erythematosus, with juvenile spondyloarthritis), and I degree opening of the mouth slightly limited and possibly in the range of 3–4 cm in 28 children (34.14%) (from juvenile systemic scleroderma, with juvenile rheumatoid arthritis, juvenile dermatomyositis to, systemic lupus erythematosus, juvenile-onset spondyloarthritis) with rheumatoid arthritis, with juvenile dermatomyositis, with systemic lupus erythematosus, with juvenile spondyloarthritis, and the first degree of mouth opening is weakly limited and is possible within 3–4 cm in 28 children (34.14%) (with juvenile systemic scleroderma, with juvenile rheumatoid arthritis, with juvenile dermatomyositis, with systemic lupus erythematosus, with juvenile spondyloarthritis). The normal opening is more than 4 cm was found in 25 children (30.05%) [Table 2].

The high degree of caries damage, bad hygiene, and restriction of mouth opening <4 mm gave impetus in search of reduced time and convenience in the treatment of caries in this group of children. The results of the study showed that this method of treatment of fissure caries turned out to be restoration using a silicone key, during which the treatment time was significantly reduced, the filling accurately reflected the anatomical structure of the tooth. Patients did not notice discomfort and fatigue during the removal of the block and restoration.

## Discussion

Children with rheumatic diseases have a highly severe general somatic pathology, due to which they have a reduced immune system, not only systemic but also local in the oral cavity. Accordingly, the dental status of these children is very low.

During the dental examination of the oral cavity of all children with RB, multiple carious lesions were found. In the first age group DMFT (average) – 4.88 in the second age group DMFT (average) – 7.58, which corresponds to a high degree of caries lesion of teeth. It is well known that in childhood, caries spread faster due to the anatomical features of the teeth. However, the prevalence of caries in children with rheumatic diseases is significantly higher not only because of the structure of the teeth but also because of the constant use of medications, especially immunotherapy, which affects the oral microflora and protective components of saliva.<sup>[23]</sup> Long use of corticosteroids disrupts metabolism and tissue tropism, as well as mainly impairs mineral metabolism, which leads to increased risk of spread and intensity of caries.<sup>[24,25]</sup> This situation demands constant dental monitoring and treatment.

**Table 2: Degrees of mouth opening in children with rheumatic diseases**

| Degree of mouth opening                    | I Grade (3-3,5 cm)<br>(n=28) 34.14% | II Grade (2-2.5 cm)<br>(n=19) 23.17% | III Grade (1.5-2 cm)<br>(n=10) 12.19% | Norm (More than 4 cm)<br>(n=25) 30.05% |
|--|-------------------------------------|--------------------------------------|---------------------------------------|--|
| Juvenile rheumatoid arthritis (JRA) (n=32) | n=12                                | n=6                                  | n=5                                   | n=9                                    |
| Juvenile systemic scleroderma (JSS) (n=25) | n=8                                 | n=7                                  | n=4                                   | n=6                                    |
| Juvenile spondyloarthritis (JS) (n=6)      | n=2                                 | n=1                                  | -                                     | n=3                                    |
| Juvenile dermatomyositis (JD) (n=8)        | n=2                                 | n=3                                  | n=1                                   | n=2                                    |
| Systemic lupus erythematosus (SLE) (n=11)  | n=4                                 | n=2                                  | -                                     | n=5                                    |

Oral hygiene of children with difficult opening of the mouth is unsatisfactory, due to arthritis, osteoarthritis, ankylosis, myositis, microstoma, and systemic sclerosis, which leads to a rapid increase of caries. The main thing to note is that the cause of poor oral hygiene is the limited opening of the mouth, but as our study showed, the low level of oral hygiene in these children is mainly associated with disorders in the joints of the upper extremities, which restrict hand movements. For children with rheumatic diseases, it is very difficult physically to carry out high-quality hygiene in general, and the problem of opening the mouth makes it completely inaccessible.<sup>[26]</sup>

In our research, the MMO index was Grade 3,2,1 - among 57 children with RD (69, 51%), which corresponded to the opening of the mouth less than 4 cm. This pathology made difficulties in the treatment of caries of these children. Similar data were received in the study of Müller *et al.*, in that they determined that the index of mouth opening in children with rheumatic diseases was <40 mm, which is the reason that the assessment of this indicator is mandatory and necessary as a comprehensive diagnosis of temporomandibular joint (TMJ) at the dentist in children with rheumatic diseases.<sup>[12]</sup> As our research shows, the difficulties with which the dentist has to face during the treatment of caries and pain in these children due to poor opening of the mouth negatively affect the psycho-emotional state of the child's health. Gualano *et al.* observed in their research that children with rheumatic diseases had symptoms such as pain, weariness, and muscle weakness, which is the cause of poor quality of life.<sup>[27]</sup> This can lead to the fact that the child will not allow to conduct quality treatment in all subsequent visits. Based on this, it is necessary to reduce stress factors, and mainly reduce the time of treatment and the number of visits.

This effect was scientifically substantiated in 2016 by Linde N. Nijhof and Elise M. van de Putte in their research "Prevalence of Severe Fatigue Among Adolescents With Pediatric Rheumatic Diseases."<sup>[18]</sup> In their research, it was found out that fatigue with prolonged opening of the mouth, among patients with rheumatic diseases, was 25.1% compared with a healthy control group. The authors link the high level of pain that is constantly experienced by the children with their indicators of fatigue. This should be kept in mind when consulting such patients and planning further treatment tactics.

Based on our research, it was found that to prevent all the problems considered, the use of the SKM is the most optimal and relevant solution to these problems. The results of our study demonstrate that the main advantage of this method is low invasiveness, simplicity, and speed of its use. At the same time, this SKM allows you to restore the correct occlusal-articulatory interrelation, which is very important considering a low level of hygiene and a high risk of developing periodontal diseases.

At present time, the question of optimal restoration of the integrity of the child's tooth is relevant, but the treatment of caries by a standard method does not provide esthetics and proper isolation in complex clinical situations, which can lead to further complications and re-treatment of teeth. In the standard caries treatment protocol, germetism may be disrupted due to uncontrolled opening and closing of the child's mouth, while portion insertion and modeling of composite material requires more time and effort for both the child and the dentist.<sup>[28,29]</sup> A pain syndrome in the TMJ, circular muscles of the mouth, masticatory muscles, which occurs in children with rheumatic diseases with prolonged opening of the mouth, did not allow the treatment of caries in one visit. Usually, during the first visit, the carious cavity is prepared and closed with a temporary filling. In the second visit, the temporary filling is extracted and the tooth is reconstituted with a composite material and the occlusion is adjusted for a long time. If everything is carried out in one visit, then pain and fatigue affect the child's behavior, which later leads to chips or loss of composite fillings, so the process must be fast and especially controlled by the doctor.<sup>[30]</sup> Therefore, the proposed method of treatment of caries is the most suitable for the treatment of such children.

## Conclusion

The use of the technique of treatment of fissure caries with the help of the SKM made it possible to display the exact anatomical shape of the tooth, significantly reduce the time of restoration, which will improve the quality of caries treatment and provide a stable result of treating patients with difficulty in opening the mouth and severe somatic pathologies.

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### Conflicts of interest

There are no conflicts of interest.

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