Case Report ISSN 2639-9490

Oral Health & Dental Science

Orthodontic Management for Sickle Cell Anemia: A Multidisciplinary Case Report

Hayder Abdalla Hashim[1]* and Mohamed H. Hashim Mohamed[2]

[1]*Professor and senior consultant, Hamad dental center, Doha/ Qatar.*

[2]*Orthodontist specialist, Private clinic.*

***Correspondence:**
Hayder Abdalla Hashim, Professor and senior consultant, Hamad dental center, Doha/Qatar, E-mail.hahashim78@yahoo.com.

Received: 04 Sep 2025; **Accepted:** 11 Oct 2025; **Published:** 22 Oct 2025

Citation: Hayder Abdalla Hashim, Mohamed H. Hashim Mohamed. Orthodontic Management for Sickle Cell Anemia: A Multidisciplinary Case Report. Oral Health Dental Sci. 2025; 9(5); 1-8.

ABSTRACT

Sickle cell anemia (SCA), a hereditary hematologic disorder linked to chronic complications, poses risks such as Vaso-occlusive crises and delayed healing during dental interventions. A 20-year-old male with SCA sought orthodontic care for severe lower incisor crowding mild upper crowding and aesthetic as well as function concerns. Utilizing a non-extraction fixed orthodontic approach, severe crowding was corrected while maintaining Class I molar/canine relationships and achieving optimal overjet and overbite. Treatment proceeded without complications, yielding satisfactory aesthetic and functional outcomes. Success was attributed to a multidisciplinary strategy integrating hematologic expertise, meticulous biomechanical planning, and proactive communication among orthodontists, and the patient. This case underscores the importance of a conservative, collaborative framework to mitigate SCA-related risks and ensure safe, patient-centered care.

Keywords

Sickle cell anemia, Crowding, Multidisciplinary teamwork, Orthodontic, Non-extraction. Hematologic expertise.

Introduction and review of literature

One crucial factor to consider before initiating orthodontic treatment for a patient with sickle cell anemia is a thorough understanding of the disease and its management, particularly the importance of ensuring adequate blood supply when applying orthodontic forces.

In 1910, Herick first introduced the term "sickle cell anemia" to describe patients with hemoglobin S (Hb-SS). This condition was classified as a blood disorder characterized by hemolytic anemia, which involves altered red blood cells and increased blood viscosity. Sickle cell anemia is a hereditary disease caused by a genetic mutation in the hemoglobin molecule. The sickling process impairs the ability of red blood cells to effectively transport oxygen to the tissues and shortens their lifespan from about 120 days to roughly 20 days [1].

The higher prevalence of malocclusions in patients with sickle cell disease can be attributed to factors such as muscular imbalances, lack of labial sealing, or alterations in the bony structure, which may necessitate orthodontic treatment [2].

During the orthodontic treatment of patients with sickle cell anemia, it is recommended to apply light, continuous forces to minimize the risk of adverse effects. When applying orthodontic forces to patients with SCA, modifications are essential due to their impaired bone remodeling capacity. It is recommended to use low and intermittent forces to avoid excessive stress on alveolar bone and reduce the risk of ischemic complications [3].

Additionally, the application of light continuous forces helps reduce the stress on the periodontal tissues and minimizes the risk of complications such as pain or bone necrosis, which can be exacerbated in patients with sickle cell anemia. Further, close monitoring of the patient's health status is essential. Regular communication with the patient's healthcare provider is advisable to ensure that any potential complications related to sickle cell

anemia are managed promptly. Furthermore, Orthodontists should be prepared with an emergency protocol in case the patient experiences a vaso-occlusive crisis during treatment. Moreover, Educating the patient and their guardians about potential risks and signs of complications is crucial for safe orthodontic management [3-6].

However, numerous studies have identified specific craniofacial features in patients with sickle cell anemia (SCA). Cephalometric analyses reveal that SCA patients often exhibit a hyperdivergent growth pattern, maxillary protrusion, and an increased mandibular plane angle, primarily due to impaired bone growth [3].

Licciardello, et al. conducted a study on Caucasian patients with sickle cell disease (SCD), comparing them to a healthy control group matched for gender and age, utilizing lateral cephalometric radiographs. Their findings demonstrated that the cephalometric analyses indicated a posterior rotation of the mandible and a tendency towards a vertical growth pattern (clockwise), with significantly increased lower face height (P=0.000) and total face height (P=0.002) in comparison to the control group. These alterations were particularly pronounced in the SCD subjects (beta(s)beta(s)). Additionally, all patients exhibited a marked proclination of the maxillary incisors compared to the control group [7].

Alves, et al. [8] conducted a review article aimed at guiding clinicians in the orthodontic treatment of patients with sickle cell anemia, referencing literature on multidisciplinary management. Key guidelines for orthodontists include being aware of the risk of pulpal necrosis in healthy teeth, the alteration in bone turnover during orthodontic movements, the occurrence of painful episodes in the mandible, and the increased susceptibility to infections. Orthodontic planning should focus on enhancing regional micro-circulation by extending rest intervals and minimizing both the movement of teeth and the forces applied. Additionally, any intense orthodontic or orthopedic forces, such as those used in extraoral anchorage or maxillary expansion, require careful handling.

Several authors have indicated that the dura-lamina remains intact, although osteoporosis can be present in certain areas. Furthermore, a trabecular pattern known as the "step ladder" was not observed in the edentulous regions [9-12].

Da Fonseca, et al. [13] published a review article aimed at pediatric dentists, highlighting that sickle cell disease is a chronic and complex multisystem condition in which these dentists play a crucial role in preventing complications and improving the patient's quality of life. Given the significant variability in the clinical manifestations of the disease, each patient should be treated on an individual basis, and it is essential to consult with the physician prior to initiating any dental care.

Case Report

A 20-year-old male presented with concerns about an unattractive smile. His medical history included sickle cell anemia, and there was no similar dental issue observed among his family members.

Clinical Examination

Extra-orally, he exhibited a symmetrical, proportionate oval face with a convex profile, incompetent lips, recessive chin, vertical mandible and an acute nasolabial angle (see Figure 1).

Figure 1: Pre-treatment extra-oral view.

Intra-oral examination indicated that the patient was in the permanent dentition stage.

From a sagittal view, dentally, the molar and canine relationship was classified as Angle Class I, with a normal overjet and a decreased overbite.

The mandibular arch was U-shaped, with all permanent teeth present except for the third molars, all other teeth were present. Notably, there was severe lingual displacement of teeth 32 and 42, and tooth 31 was rotated.

The maxillary arch was ellipsoid in shape, with tooth 11 mildly overlapping 21, and tooth 12 was displaced palatally (see Figure 2).

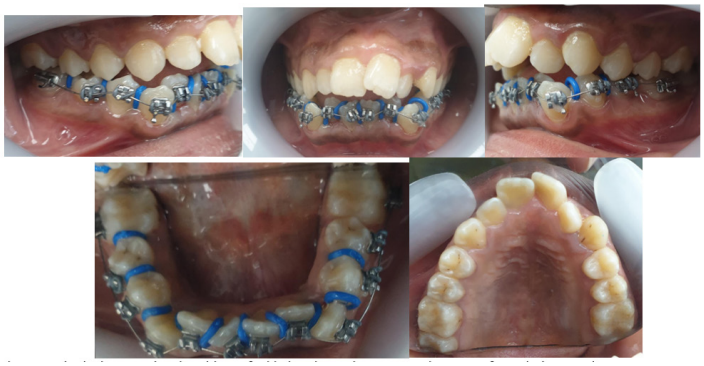

Figure 2: Pretreatment intra oral view of upper arch. Lower arch was bonded before taking the photographs in the same day.

Radiographic Examination

Cephalometric analysis of the patient's radiographs revealed the following skeletal and dental characteristics (See Figure 3):

Skeletal Class II Relationship: This indicates that the mandible is positioned posteriorly relative to the maxilla.

Steep Mandibular Angle: This suggests a vertical growth pattern of the mandible.

Deficient Chin: This refers to a lack of anterior projection of the chin. Obtuse mentolabial angle

Bimaxillary Protrusion: This indicates that both the upper and lower teeth are positioned forward relative to the facial profile.

Radiographic Examination

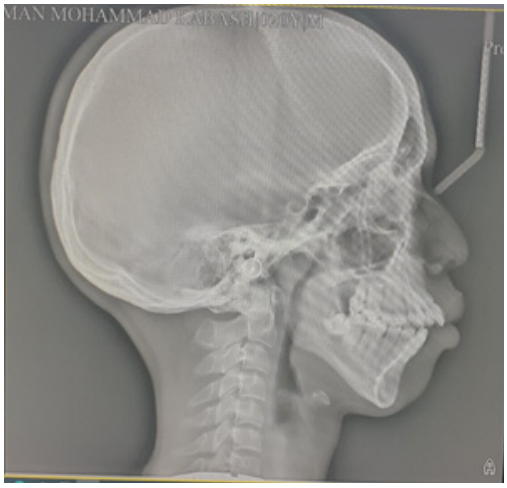

Figure 3: Pretreatment cephalometric radiograph.

Radiographic Examination (Orthopantomogram)

The orthopantomogram (panoramic X-ray) confirmed the presence of all permanent teeth in both the upper and lower arches. However, the lower third molars were impacted (unable to erupt normally), and no upper third molars were present (See Figure 4).

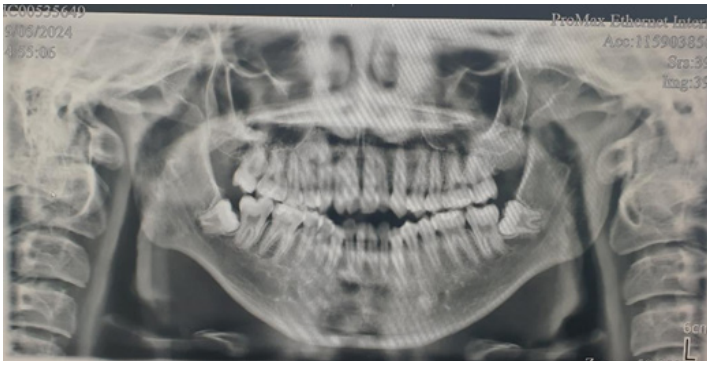

Figure 4: Pretreatment. Orthopantomogram.

Treatment aims

The treatment objectives were to align both the maxillary and mandibular arches while preserving an Angle Class I molar and canine relationship. Additional goals included correcting the midline, adjusting the overjet and overbite, and achieving proper intercuspation.

After discussing various treatment options with the patient's parents, a decision was made to proceed with a straight-wire orthodontic appliance without extracting any mandibular incisors. Prior to initiating treatment, a consent form was signed.

Treatment progress

Lower arch: Leveling and alignment phase

Treatment of the mandibular arch began with the bonding of 0.022 slot MBT brackets (Figure 5). The first wire utilized for leveling was a 0.012 Nitinol arch wire. The progression of arch wires then included 0.016 Nitinol, 0.016 Stainless Steel arch wire with open coil to regain space for 31and 32 (Figure 6).

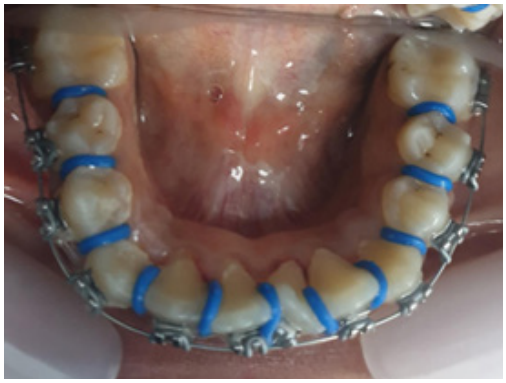

Figure 5: Separators were placed.

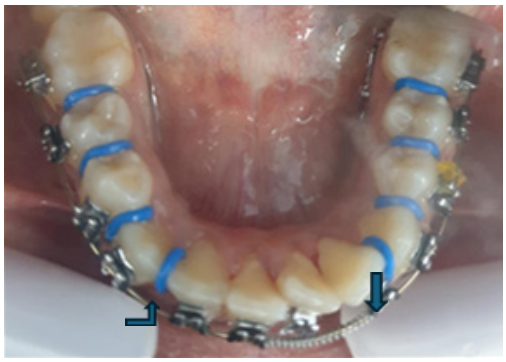

Figure 6: Open coil to gain space for 31and 32.

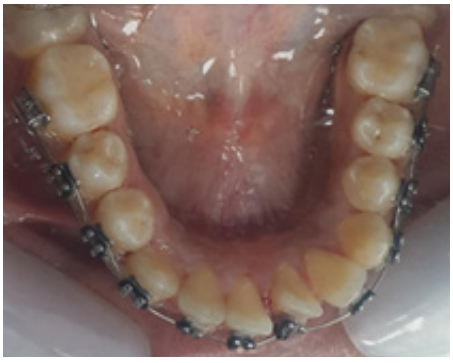

Figure 7: One month later, Space was gained for partial alignment of 31,32, 41 .0.014 Niti arch wire fully ligated for de-rotation of 31.

Movement phase

Procedures to facilitate lower incisor alignment and repositioning of #32 and #42 included interproximal reduction (stripping) from #33 to #43 and the insertion of an open coil spring (Figure 6).

Separators were also placed inter-proximally from the mesial of #36 to #46. For elastic wear, the patient was directed to use Class III elastics (3/16") as well as using triangle elastic 3/16.4.5 oz in the right side while using Class II elastics 5/16", 4.5 oz in the left side (Figure 8).

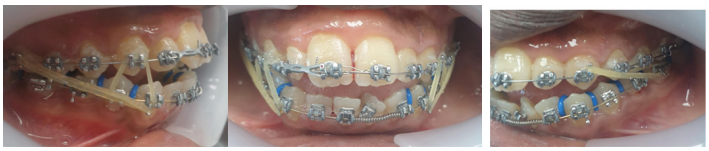

Figure 8: Patient instructed to use Class 3 elastic in the right side + triangle 3/16. Class 2 elastic 5/16. 4.5 oz in the left side.

Contraction Phase (Space Closure)

Following the successful realignment of the lower incisors, the next stage involved closing the remaining spaces.
A 0.016" x 0.022" Nitinol wire was initially ligated into the lower incisor segment.

Subsequently, a 0.016" x 0.022" Stainless Steel (SS) contraction archwire with Bull loop + power chain from the bull Loop to lower first molar hook bilaterally utilized to retract the lower incisors.

The goal of this retraction was to achieve the desired overbite and a normal positive overjet as well as closing remaining spaces (Figure 9).

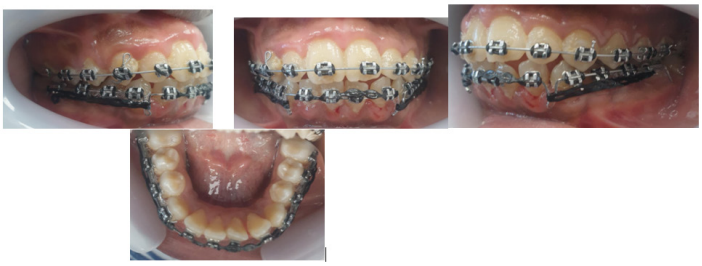

Figure 9: Contraction phase in the lower arch (space closure).

Finishing Stage in mandibular arch

The final stage focused on refining the occlusion and achieving optimal intercuspation.

During this stage, 0.019" x 0.022" Nitinol arch wires were employed to finalize the tooth positions and achieve the desired occlusal relationships.

Maxillary arch

Leveling and Alignment Phase

This phase focused on initial tooth movement to achieve proper alignment and leveling. Similarly, 0.022" slot MBT brackets were bonded to the upper arch.

An initial 0.012" Nitinol leveling archwire was inserted in the upper arch with full ligation of tooth 12 (Figure 10). The subsequent archwire used in the upper arch was a 0.016" Nitinol wire, a 0.016" Stainless Steel (SS) wire and a 0.018" Australian archwire and 0.016 x 0.022 Nitinol arch wires were utilized in the upper arch (Figure 11).

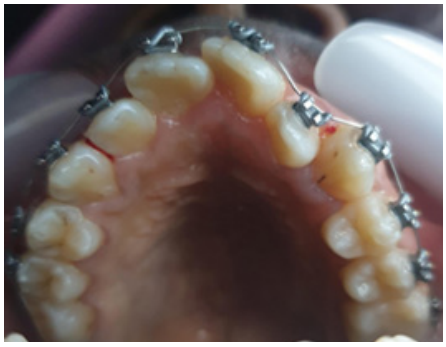

Figure 10: Upper arch 0.012 Niti during Upper arch after alignment and leveling.

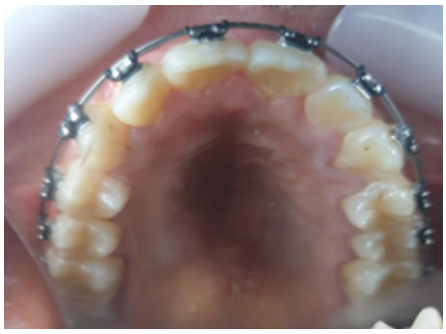

Figure 11: 0.016 x 0.022 Niti leveling and alignment.

Finishing Phase in maxillary arch

This phase aimed to refine the tooth positions and achieve the final desired occlusion. The archwires used in this phase included: 0.017" x 0.025" nitinol. Finally, 0.019" x 0.025" Nitinol arch wire.

Retention Phase and Treatment Result.

Upper and lower arches were debonded when all treatment objectives were achieved. Upon achieving all the objectives and successful completion of orthodontic treatment, both upper and lower arches were debonded.

Maxillary vacuum-formed retainers were provided as well as mandibular vacuum in addition to lower fixed bonded retainer (33 to 43) to maintain the achieved results. Appropriate instructions regarding the use and care of the retainers were given.

Discussion

Sickle cell anemia (SCA), a prevalent inherited hematologic disorder, is characterized by chronic morbidity and mortality due to its pathophysiological effects. The characteristic sickling process disturbs oxygen transport, as red blood cells lose their deformability and undergo premature destruction, reducing their lifespan from 120 days to approximately 20 days. This systemic compromise not only impacts overall health but also poses risks to

Figure 12: Post-treatment intra oral view of upper and lower arch + fixed lower 33 to 43 bonded retainer.

oral tissues, including impaired vascular supply and altered bone metabolism [14].

Orthodontic management in SCA patients requires meticulous consideration of these systemic vulnerabilities. Reduced vascular integrity and susceptibility to osteonecrosis—particularly in the mandible—increase risks during treatment. The application of orthodontic forces must be carefully calibrated to avoid exacerbating complications such as periodontal deterioration, delayed healing, or root resorption. Consequently, a multidisciplinary approach, integrating hematologic and dental expertise, is essential to optimize treatment safety and efficacy [14,15].

This report details a 20-year-old male with SCA under regular medical supervision, seeking orthodontic care for severe lower arch crowding as well as a V-shaped upper arch with mild crowding, a palatally displaced upper left lateral incisor, and rotated upper central incisors. The patient's concerns centered on compromised smile aesthetics, masticatory dysfunction, and oral hygiene challenges, underscoring the intersection of SCA-related systemic factors and dental health. Addressing these issues demanded a tailored orthodontic strategy to mitigate biomechanical stress on compromised tissues while restoring functional and aesthetic outcomes.

The cephalometric analysis revealed a skeletal Class II relationship with a steep mandibular plane angle and retrognathic chin position, indicating underlying skeletal discrepancies contributing to the malocclusion. These skeletal patterns were compounded by bimaxillary dentoalveolar protrusion, suggesting compensatory forward positioning of the anterior teeth within the existing skeletal framework. Addressing both skeletal and dental components will be critical to achieving long-term occlusal stability and harmonious facial aesthetics, particularly given the interplay between vertical growth patterns and anterior tooth inclination.

The orthopantomogram demonstrated impacted lower third molars, a common finding in young adults that may necessitate future evaluation for prophylactic extraction to mitigate risks of cyst formation, crowding relapse, or periodontal compromise.

The absence of upper third molars fall within normal anatomical variation and does not preclude orthodontic intervention. Notably, the presence of all other permanent teeth provides a favorable foundation for comprehensive treatment planning.

The pathophysiology of sickle cell anemia (SCA)—marked by chronic hypoxia due to impaired oxygen delivery and a shortened red blood cell lifespan—increases risks to oral tissues, including delayed wound healing and compromised vascular integrity [16,17]. These systemic effects necessitate orthodontic strategies that balance aesthetic and functional goals with precautions to safeguard periodontal health and reduce biomechanical stressors [18]. This case highlights the imperative for multidisciplinary collaboration, integrating hematologic and dental expertise, to achieve optimal outcomes in patients with SCA and other hematologic disorders [19].

Orthodontic treatment in patients with Sickle Cell Anemia (SCA) presents unique challenges and potential risks that necessitate careful consideration and a multidisciplinary approach. While the desire for a healthy and aesthetically pleasing smile is universal, the systemic implications of SCA can significantly impact the safety and success of orthodontic intervention. Understanding these risks and implementing appropriate preventative measures is crucial for providing optimal care to this vulnerable patient population. However, there are very few published case reports in the literature [16-22].

This present case demonstrates the successful orthodontic management of a patient with sickle cell anemia (SCA) presenting with craniofacial and dental abnormalities. Treatment achieved all objectives, including normalization of overjet and overbite, resolution of severe crowding and camouflage of the Class II skeletal pattern. Additionally, lip incompetence was corrected, enabling comfortable lip closure without muscular strain.

The Key considerations for Orthodontic treatment in sickle cell anemia (SCA) patients requires meticulous planning to mitigate risks such as Vaso-occlusive crises (VOCs) and impaired bone healing. Light orthodontic forces, though seemingly harmless, may induce local inflammation or biomechanical stress, triggering VOCs characterized by severe craniofacial pain and, rarely, complications like stroke or avascular necrosis of the temporomandibular joint (TMJ) [16,17]. Additionally, chronic anemia and compromised vascular integrity in SCA impair bone remodeling, potentially delaying tooth movement, increasing root resorption risk, and complicating adjunctive surgical procedures (e.g., extractions or orthognathic surgery) [20,23]. To minimize adverse outcomes, orthodontists should adopt conservative biomechanics, prioritize non-invasive approaches, and collaborate closely with hematologists [18,19].

The psychological and emotional toll of sickle cell anemia (SCA) must be carefully acknowledged in orthodontic care. Patients often endure chronic pain, recurrent hospitalizations, and the looming threat of complications, which can diminish their capacity to manage the accuracy of orthodontic treatment. Challenges such as sustaining optimal oral hygiene and adhering to frequent clinical appointments may be exacerbated by these systemic stressors, necessitating a compassionate, patient-centered approach to care [16,23].

The outcomes highlight that early dental intervention can significantly enhance quality of life for SCA patients as many such issues are manageable during growth. The orthodontist should arrange conservative approaches, minimizing invasive procedures like extractions and avoiding excessive mechanical forces to reduce stress. Proactive oral health care and timely orthodontic consultation are encouraged for this population to mitigate severe complications and improve long-term outcomes.

As mentioned earlier; although research on orthodontic treatment for individuals with sickle cell anemia remains sparse, case reports by Oluwatosin et al. [21] and Pithon [22] provide insight into this clinical context. However, case reports suggest that SCA patients undergoing orthodontic treatment may develop complications such as delayed tooth movement, osteonecrosis, and periodontal breakdown. A retrospective study by Al-Jamal, et al. [24] emphasized the importance of radiographic monitoring during orthodontic therapy, recommending frequent follow-ups to assess bone integrity and tooth mobility.

Recently, Ganga Girish, et al. described a case of a 21-year-old woman with sickle cell disease (SCD) and asthma who experienced vaso-occlusive pain after using an electronic nicotine dispensing system (ENDS). While further rigorous studies are needed, this suggests that ENDS may acutely worsen SCD complications, particularly in patients who had asthma in addition to sickle cell disease [25].

Very recently, Durand et al. reported a 22-year-old Congolese male with SCD hospitalized for a hip VOC who developed facial cellulitis. Initially suspected to be dental-related due to nonspecific clinical and radiological findings, his delayed post-surgical healing led to a diagnosis of jawbone osteomyelitis. They emphasized that diagnosing osteomyelitis in SCD patients can be difficult, as signs are often subtle, and urged dental professionals to remain alert. Prompt investigation is crucial to differentiate it from dental conditions and prevent severe complications [26].

In the current case, proactive measures were adopted to mitigate the risk of Vaso-occlusive crises, prioritizing strict preventive care protocols and light force during the entire course of orthodontic therapy**.** The patient declined a referral to oral axillofacial surgery for removal of both horizontally impacted lower third molars, as he is not experiencing any symptoms Figure 12.

It is recommended for best practices and safe orthodontic management for SCA patients in orthodontics, the following measurement should be followed:

A. Using light continuous forces to reduce stress on alveolar bone.
B. Avoiding extractions unless necessary due to healing concerns.
C. Ensuring optimal oxygenation and hydration during appointments to prevent Vaso-occlusive crises.
D. Collaborating with hematologists to monitor systemic status and manage risks effectively [27].
E. Patients with SCA need strict oral hygiene practices, including thorough instruction on brushing, flossing, and interdental care. Regular professional cleanings and monitoring for gum disease are essential to maintain oral health.
F. Prophylactic Antibiotics: Use antibiotics as needed during procedures like extractions, in consultation with the hematologist, to prevent infection.
G. Stress Reduction: Provide emotional support and encouragement to enhance compliance and well-being.
H. Monitoring: Continuously watch for complications such as pain, swelling, or tooth mobility, and communicate promptly with the patient and hematologist if issues arise.
I. Education: Inform patients and parents about treatment risks, benefits, and signs of problems to ensure safe and effective care.

Lastly, the psychological and emotional challenges of living with SCA should be considered. Chronic pain, frequent hospital visits, and the risk of complications can affect a patient's ability to manage orthodontic treatment, including maintaining good oral hygiene and consistently attending appointments.

Conclusion

Orthodontic treatment for patients with sickle cell anemia (SCA) provides functional and aesthetic improvements but demands cautious risk management due to the systemic challenges posed by the disease.

Clinicians must have in-depth knowledge of SCA and its therapeutic strategies, as preserving sufficient blood flow is crucial when applying intraoral or extraoral orthodontic forces. This awareness helps reduce risks such as Vaso-occlusive episodes or delayed tissue healing.

A conservative, interdisciplinary strategy—rooted in understanding SCA's pathophysiology, coordinated care with hematologists, oral surgeon and precise biomechanical adjustments—is essential for safe treatment. Clear, ongoing communication among the orthodontic team, patient, and healthcare providers ensures alignment, prioritizing patient safety and individualized outcomes.

Acknowledgment

The authors would like to express their gratitude to Mary Jane Baldovino for her assistance during the treatment of this patient.

References

1. Santos GER. Enfermagem no Tratament da Anemia Falciforme. Sao Paulo Brazil: Editora EPU. 1999; 95.
2. Okafor LA, Nonnoo DC, Ojehanon PI, et al. Oral and dental complications of sickle cell disease in Nigerians. Angiology. 1986; 37: 672-675.
3. Sharma M, Sharma P. Orthodontic Management in Patients with Sickle Cell Anemia: A Review. Indian Journal of Dental Sciences. 2021; 13: 115-118.
4. Vayvada H, Korkmaz Y. Sickle Cell Anemia: Implications for Dental Care. The Journal of Dental Hygiene. 2011; 85: 494-499.
5. Bahl R, Kaur J. Management of dental patients with sickle cell disease. Journal of Clinical and Experimental Dentistry. 2017; 9: 493-498.
6. Peters GS, Nair MK. Managing Treatment of Sickle Cell Disease: A Dentists Perspective. International Journal of Pediatric Dentistry. 2018; 28: 511-520.
7. Valeria Licciardello, Gregoria Bertuna, Piera Samperi. Craniofacial morphology in patients with sickle cell disease: a cephalometric analysis. Eur J Orthod. 2007; 29: 238-242.
8. Milanezi Alves, Daniele Karina M Alves, Margareth Maria Gomes de Souza. Orthodontic Treatment of Patients with Sickle-cell Anemia. Patricia Vale´ria Angle Orthodontist. 2006; 76: 269-273.
9. Robinson IB, Sarnat BG. Roentgen studies of the maxillae and mandible in sickle-cell anemia. Radiology. 1952; 58: 517-523.
10. Morris AL, Stahl SS. Intraoral roentgenographic changes in sickle-cell anemia; a case report. Oral Surg Oral Med Oral Pathol. 1954; 7: 787-791.
11. Soni NN. Microradiographic study of dental tissues in sickle cell anemia. Arch Oral Biol. 1966; 11: 561-564.
12. Nelson DA, Rizvi S, Bhattacharyya T, et al. Trabecular and integral bone density in adults with sickle cell disease. J Clin Densitom. 2003; 6: 125-129.
13. Marcio da Fonseca, Hassan S Oueis, Paul S Casamassimo. Sickle Cell Anemia: A Review for the Pediatric Dentist. Pediatr Dent. 2007; 29: 159-169.
14. Costa CP, Maia LC, Barros SE, et al. Orthodontic considerations for patients with sickle cell disease: a systematic review. Angle Orthod. 2021; 91: 407-415.
15. Neville BW, Damm DD, Allen CM. Oral and maxillofacial pathology. Elsevier. 2015.
16. Frédéric B Piel, Martin H Steinberg, David C Rees. Sickle Cell Disease. The New England J Med. 2017; 376: 1561-1573.
17. Costa CP, Thomaz EB, Souza Sde F. Association between sickle cell anemia and pulp necrosis. J Endod. 2013; 39: 177-181.
18. Naranjo AA, Trivino ML, Jaramillo A, et al. Dental and periodontal health in adults with sickle cell disease. J Periodontol. 2016; 87: 1146-1152.
19. Buchanan GR, De Baun MR, Quinn CT, et al. Sickle cell disease. Hematology Am Soc Hematol Educ Program. 2004;

35-47.

20. Almeida RCC, Almeida Pedrin RR, Silva Filho OG, et al. Orthodontic treatment in a patient with sickle cell anemia: a case report. Am J Orthod Dentofacial Orthop. 2020; 158: 410-420.
21. Oluwatosin SO, Oredugba AF, Edamisan TO. Orthodontic management of traumatic avulsion of permanent incisors in a child with sickle cell anemia: case report. Cases J. 2009; 2: 8123.
22. Pithon MM. Orthodontic treatment in a patient with sickle cell anemia. Am J Orthod Dentofacial Orthop. 2011; 140: 713-719.
23. Al Rayes HM, Al Sadhan SA, Al Mohaya MA. Sickle cell disease and oral health: a review. Saudi Dent J. 2019; 31: 171-176.
24. Al Jamal G, Hazzaa AM, Rawashdeh MA. Cephalometric measurements in Jordanian children with sickle cell anemia. Angle Orthod. 2016; 86: 451-457.
25. Ganga Girish, Bingtao Xiang, Lewis L Hsu. A 21-Year-Old Woman with Sickle Cell Disease and Vaso-Occlusive Pain Associated with Using an Electronic Nicotine Dispensing System (E-Cigarette or Vape) – a Case Report. Am J Case Rep. 2023; 24: 941268.
26. Rémi Durand, Zoé Gaudimier, Yohann Flottes, et al. Sickle cell disease and jawbone osteomyelitis: case report and literature review. J Oral Med Oral Surg. 2025; 31: 19.
27. Rada RE, Bronson JJ. Dentistry and the sickle cell patient. Gen Dent. 2020; 68: 50-57.

Prof. Hayder A. Hashim Dr. Mohamed H. Mohamed