



Outcome Assessment of SSCs for Patients with Amelogenesis Imperfecta

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Abstract

Purpose: Amelogenesis imperfecta (AI) is a congenital dental condition that permanently weakens enamel, making teeth more susceptible to attrition, erosion, sensitivity, and caries. This increases the risk of premature extractions and subsequent malocclusions in this patient population. This study aims to evaluate the impact of stainless steel crowns (SSCs), in reducing extractions and orthodontic treatment needs in pediatric patients with AI.

Methods: A retrospective cohort study was conducted at Boston Children’s Hospital, analyzing dental records of patients with defective enamel between January 2010 and February 2024. Data collected included SSC placement, premature extractions, and malocclusion patterns.

Results: Of the 48 patients we reviewed, 60.42% received protective SSCs, primarily placed on primary molars before age 8. Malocclusion patterns included were deep bite (28.57%), Class II malocclusion (47.62%), Class III malocclusion (14.29%) and anterior crossbite (19.05%), which are all higher than typical population. For patients who received SSCs at age 5 or younger, the average time between SSC placement and extractions was 43.1 months. For patients who received them after age 5, the average time decreased to 18.5 months. 79.31% of patients who received SSCs had them placed in the operating room (OR) under general anesthesia, which allows for extensive treatment at a young age, with an average of 11.83 teeth treated per visit.

Conclusions: Protective SSCs help preserve dentition and delay premature extractions in patients with enamel defects. Utilization of the OR allows for comprehensive care. Given the high prevalence of malocclusion, early interdisciplinary collaboration is essential for effective treatment planning.

Introduction

Amelogenesis imperfecta is a congenital dental condition that disrupts enamel formation and affects 1 in 14,000-16,000 people in the United States.¹ Ameloblasts have limited reparative capacity; thus any interference with the amelogenesis or mineralization process results in permanent structural weaknesses of enamel.² Conditions such as AI and hypo-mineralization compromise enamel integrity, making teeth more prone to attrition, erosion, sensitivity, and decay.

Without appropriate intervention, these patients are at increased risk for premature extractions, which then contribute to the development of malocclusions and increased orthodontic treatment needs. Ensuring optimal dental care for patients with AI or other enamel defects is essential for preserving their oral health and overall well-being.³ Raising awareness among dental providers about effective management strategies is crucial for improving long-term outcomes in this population. Effective protective treatments includes the use of stainless steel crowns in children with primary and early mixed dentition. These restorations provide full coronal coverage, effectively managing tooth sensitivity and reinforcing structurally compromised molars.⁴

This study evaluates the role of early protective interventions, particularly SSC placement, in minimizing the need for extractions and mitigating subsequent orthodontic complications in patients with enamel defects. By analyzing protective measures and malocclusion patterns, we aim to provide insights that encourage early dental management and orthodontic evaluation. Ultimately, our findings underscore the importance of interdisciplinary collaboration in developing timely, effective treatment strategies for this high-risk patient population.

Methods

This study was a retrospective cohort study of previously rendered dental and orthodontic treatments for pediatric patients with enamel defects. Patient charts from January 2010 to February 2024 were screened to identify patients of record at the BCH Dental Clinic with a medical diagnosis of amelogenesis imperfecta or enamel hypoplasia. The inclusion criteria of the study were: (1) a diagnosis of amelogenesis imperfecta and/or enamel hypoplasia, (2) at least 2 years of age, (3) an initial comprehensive or periodic evaluation performed. Patient charts were retrospectively analyzed for comprehensive initial or periodic examinations, consultations, evaluations, and treatment appointments with a pediatric dentist, orthodontist, or prosthodontist, as well as records of composite crowns, stainless steel crowns, operating room visits, and clinical notes. Demographic variables included the patient’s date of birth and gender. Additional patient characteristics, such as patient age at treatment received in the operating room, age at premature extractions, and medical history, were documented. Information regarding orthodontic treatment, including referral date and patient age at referral, was noted.

Results

Our study examined 48 patients who were diagnosed with an enamel defect. 34 patients (70.83%) underwent procedures to protect their teeth, including SSCs, strip crowns, Zirconia crowns, composite build-up, and resin-modified glass ionomer restorations. 29 patients (60.42%) received SSCs as a protective measure. 23 of the patients who received SSCs (79.31%), underwent this treatment in the OR under general anesthesia. An average of 11.83 teeth were treated per OR visit.

Figure 1. SSC placement by tooth type. 187 stainless steel crowns were placed in total. 144 of these SSCs (77.01%) were placed on primary molars

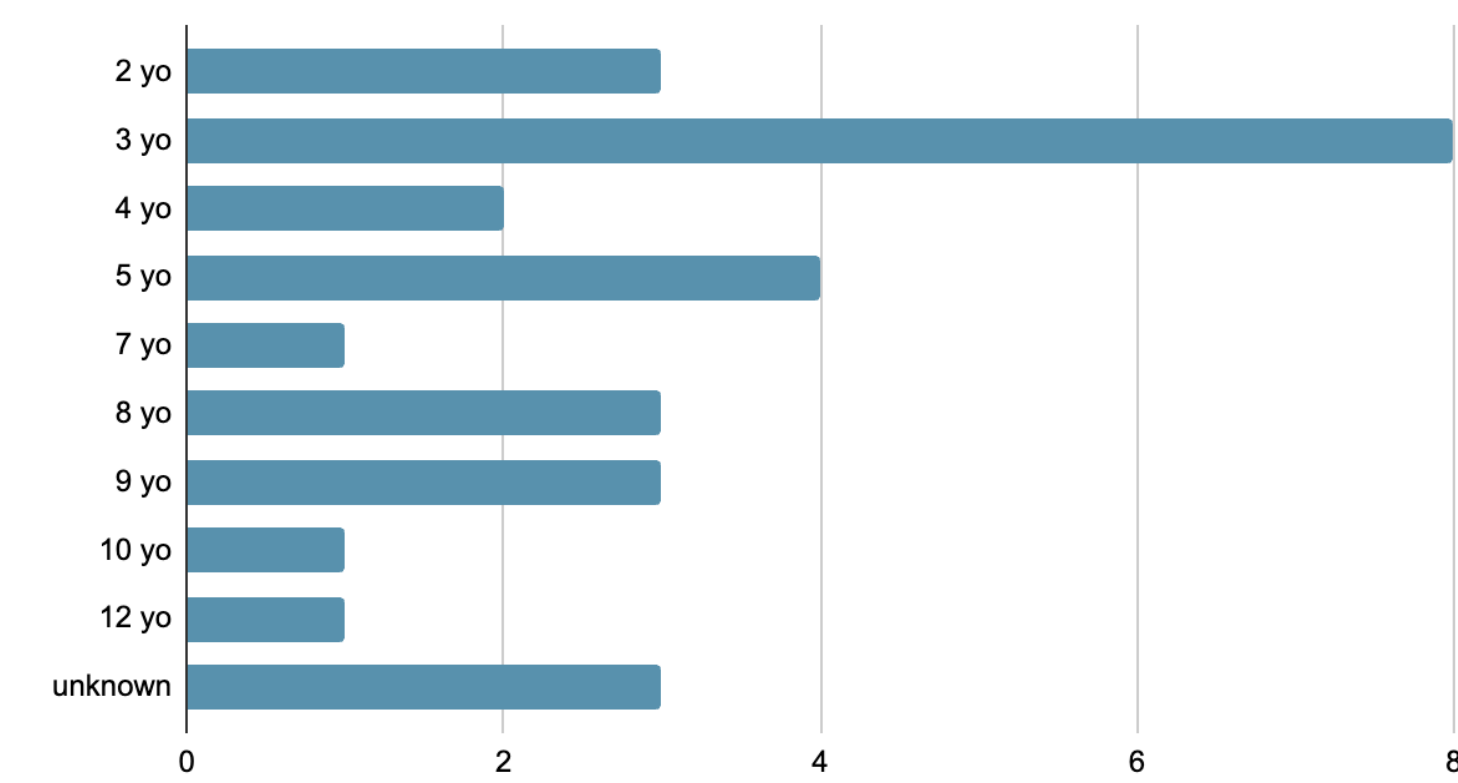
Tooth Type	# of Maxillary SSCs	# of Mandibular SSCs	Total # of SSCs
Primary incisors	3	2	5
Primary canines	4	6	10
Primary 1st molars	33	36	69
Primary 2nd molars	37	38	75
Total primary teeth	77	82	159
Permanent 1st molars	10	16	26
Permanent 2nd molars	0	2	2
Total permanent teeth	10	18	28
Total	87	100	187

Our study defined “premature extractions” as the extraction of a tooth before the normal expected period of exfoliation.⁵ Reasons include caries or root resorption.

Figure 3. Premature extractions by Tooth Type. 26 patients (54.17%) underwent premature extractions. 119 total teeth were extracted. 83 (69.75%) were primary teeth and 36 (30.25%) were permanent teeth.

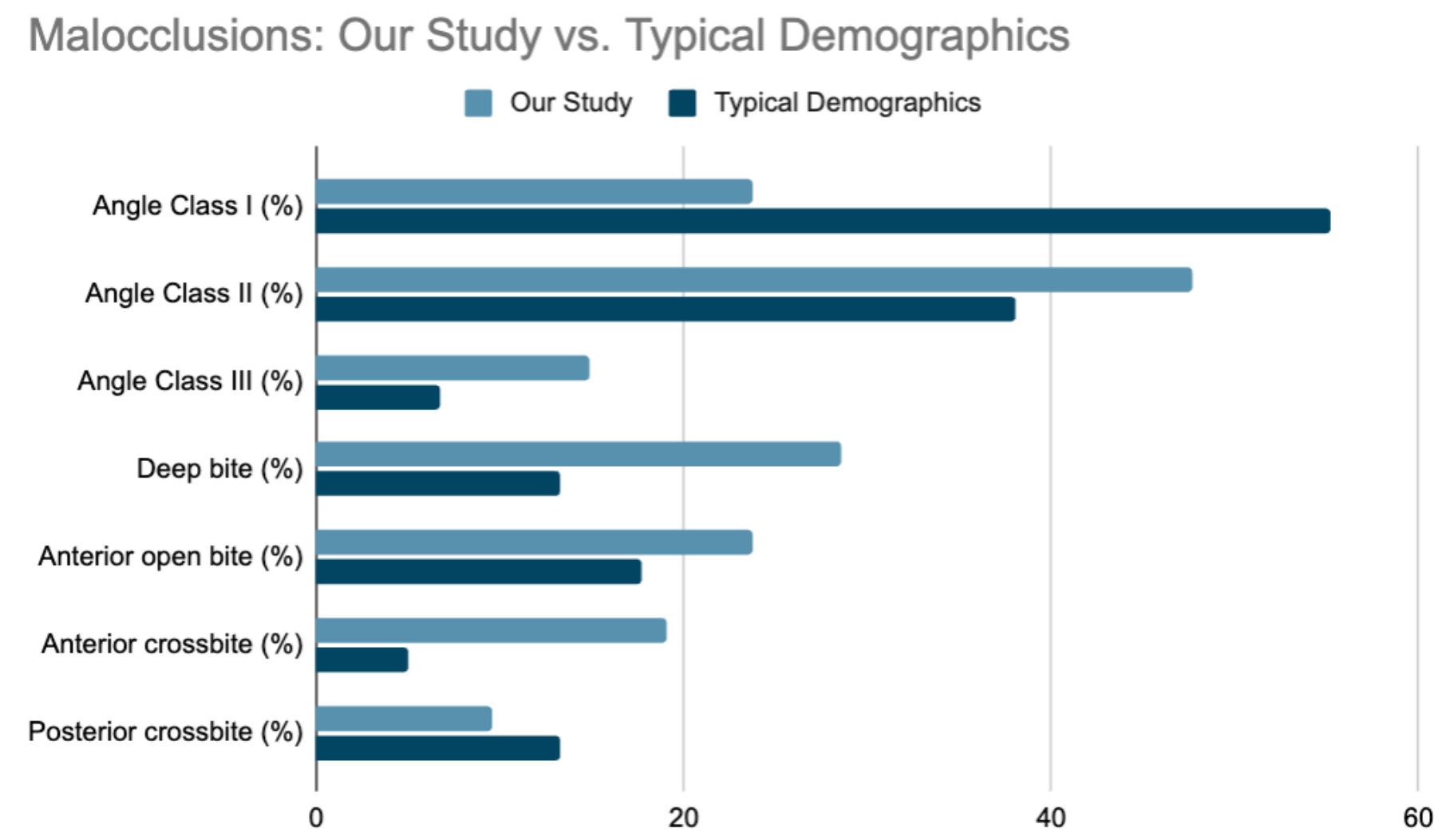
Tooth Type	# of Max. Extractions	# of Mand. Extractions	Total # Extractions
Primary incisors	16	4	20
Primary canines	12	6	18
Primary 1st molars	10	10	20
Primary 2nd molars	10	15	25
Total primary teeth	48	35	83
Permanent 1st premolars	0	2	2
Permanent 2nd premolars	2	0	2
Permanent 1st molars	14	12	26
Permanent 2nd molars	2	4	6
Total permanent teeth	18	18	36
Total	66	53	119

Figure 2. SSC placement by age. 21 SSC patients (72.41%) had them placed at or before age 8.



12 patients received protective measures, such as SSCs, and underwent premature extractions. 4 of these patients had these procedures done on different teeth in a single OR visit under general anesthesia. The other 8 patients underwent extractions after protective measures were taken. For patients who received protective measures at 5 years old or younger, the average time between SSC placement and extractions was 43.1 months. For patients who received the SSCs after the age of 5, the average time decreased to 18.5 months.

Figure 4. Malocclusion distribution compared to typical demographics.⁸ The following malocclusion demographics include overlapping diagnoses: 5 cases of Angle Class I (23.81%), 10 cases of Angle Class II (47.62%), 3 cases of Angle Class III (14.29%), 6 cases of deep bite (28.57%), 5 cases of anterior open bite (23.81%), 4 cases of anterior crossbite (19.05%), and 2 cases of posterior crossbite (9.52%).



Discussion

This study highlights the importance of early protective interventions in managing enamel defects, such as those seen in patients with Amelogenesis imperfecta. The high prevalence of SSC placement (60.42%) reinforces their role as an effective treatment for preserving compromised dentition, particularly in primary molars (77.01%). Maintaining primary dentition is critical in preventing premature extractions and associated malocclusions, which may necessitate orthodontic treatment. The significant number of patients (79.31%) receiving SSCs under general anesthesia, with an average of 11.83 teeth treated per visit, demonstrates the efficiency of managing extensive enamel defects in an operating room setting. 72.41% of SSCs placed at or before age 8 reinforces the need for early intervention. SSC placement also appears to delay premature extractions. Patients receiving SSCs at age 5 or younger experienced an average delay of 43.1 months before extraction, compared to 18.5 months for those treated after age 5. This demonstrates the importance of early intervention in preserving dentition and reducing space loss. Malocclusion patterns in this population further highlight the need for early intervention. Excessive enamel wear contributes to a reduced vertical dimension of occlusion, with a higher prevalence of Class II malocclusion (47.62%), deep bite (28.57%), anterior crossbite (19.05%), and Class III malocclusion (14.29%), compared to typical demographics. The reduced prevalence of Class I malocclusion (23.81%) underscores the impact of Amelogenesis imperfecta on dental development. However, SSC placement may help preserve occlusal stability over time. Future research should explore methods to enhance SSC durability and investigate alternative protective materials to improve treatment strategies. By prioritizing early intervention and working closely with orthodontists, pediatric dentists can play a crucial role in improving long-term oral health outcomes for patients with enamel defects, minimizing the need for extractions and orthodontic treatment, while preserving long-term function and esthetics throughout childhood and into adulthood.

Clinical Recommendations

1. Prioritize Early Protective Intervention

- Initiate restorative treatment as early as possible for patients with Amelogenesis imperfecta.
- Consider SSCs and space maintainers for primary molars to preserve tooth structure, prevent premature extractions, and maintain arch integrity.
- SSC placement before age 5 extends the average time before extraction to 43.1 months, compared to 18.5 months for those receiving SSCs later.
- Early intervention helps maintain primary dentition, preventing space loss and reducing the severity of developing malocclusions.

2. Utilize the OR for Extensive Treatment

- OR-based SSC placement under general anesthesia is an effective approach for young patients with extensive enamel defects.
- Treating multiple teeth in a single OR visit (11.83 teeth per visit) minimizes progressive enamel breakdown and reduces the need for multiple treatment sessions.

3. Monitor for SSC Failures and Space Maintenance

- Patients with AI are at higher risk for SSC failure, recurrent decay, and premature tooth loss.
- Implement frequent follow-ups and oral hygiene education for patients and caregivers.
- Use space maintainers when extractions are unavoidable to prevent unwanted tooth movement and preserve occlusal stability.

4. Evaluate Occlusion and Collaborate with Specialists

- AI often leads to reduced vertical dimension of occlusion, increased Class II and III malocclusions, deep bite, and anterior crossbite.
- Close collaboration between pediatric dentists and orthodontists ensures optimal long-term occlusal development and oral-health outcomes.

By implementing these recommendations, pediatric dentists can play a pivotal role in preserving dentition, maintaining occlusal function, and improving long-term outcomes for patients with enamel defects.

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