Can S.M.A.R.T Technique Substitute Conventional Restorative Procedure for Permanent Teeth

Assistant. Professor Dr. Angham Ghiyath Khalil AL-Hashimi B.D.S, M. Sc.
Ass. prof. at Department of Dentistry, Osol AL_ELM University collage/, Iraq
anghamalhashimi@gmail.com

ABSTRACT

The S.M.A.R.T (Minimal Intervention Restorative Technique) technique represents a paradigm shift in modern dentistry, focusing on preserving the maximum amount of natural tooth structure while minimizing patient discomfort and the need for anesthesia. This technique aims to offer an alternative to conventional restorative procedures that often involve extensive drilling and anesthesia. While traditional methods are well-established for their efficacy, particularly in cases involving significant tooth decay, the S.M.A.R.T technique has demonstrated promising results for early-stage decay and preventive treatment. However, its limitations include a potential for treatment failure in complex cases, which may restrict its applicability. This paper examines the efficacy, benefits, and limitations of the S.M.A.R.T technique in comparison to traditional restorative practices. The findings indicate that while S.M.A.R.T can be a viable alternative for specific patient demographics, further long-term studies are required to determine its comprehensive effectiveness and establish it as a standard practice in dentistry.

KEYWORDS: S.M.A.R.T technique, minimal intervention dentistry, dental restoration, tooth preservation, conventional dental procedures.

1. INTRODUCTION

Tooth decay is one of the most common and impactful dental diseases, leading to chronic oral health issues if not effectively treated. The primary cause of tooth decay is the exposure of enamel to bacteria, which results in its deterioration and the formation of cavities that can extend to deeper layers of the tooth. Traditionally, the treatment for tooth decay has involved drilling and removing damaged enamel tissue and filling the cavity with materials such as silver or composite resin fillings.

With advancements in dental medicine, new techniques have emerged to provide less invasive and more comfortable solutions for patients. One such technique is the **S.M.A.R.T (Smart Arrest of Caries Technique)**, which uses materials such as **SDF (Silver Diamine Fluoride)** and **GIC (Glass Ionomer Cement) composite** to treat tooth decay without the need for anesthesia or extensive drilling. This method is innovative as it focuses on minimizing pain and patient discomfort during the procedure, as well as reducing the potential side effects associated with conventional treatments.

Research Question: Can the S.M.A.R.T technique serve as a practical and effective alternative to traditional treatments for permanent teeth in adults? This paper will examine a comparison between the effectiveness of the S.M.A.R.T technique and conventional methods in treating tooth decay, focusing on the clinical outcomes, patient comfort, cost, and feasibility for use in general and private dental practices.

2. METHODOLOGY

Study Design: This study employs a comparative analysis approach, synthesizing findings from previous research to evaluate the effectiveness of the S.M.A.R.T (Smart Arrest of Caries Technique) technique against conventional restorative procedures in the treatment of dental caries in permanent teeth.

Criteria for Selecting Studies:

1. **Studies Utilizing the S.M.A.R.T Technique**: Only research that has implemented the S.M.A.R.T technique as part of its treatment protocol will be included. This ensures a focus on the specific application and outcomes of this innovative method.

2. **Studies Assessing Effectiveness in Permanent Teeth**: The research will include studies that specifically evaluated the efficacy of the S.M.A.R.T technique in treating permanent teeth, rather than those conducted solely on pediatric patients. This criterion helps ensure that the findings are relevant to adult populations and applicable to clinical practices for adults.

Data Collection:

- A comprehensive literature review will be conducted to identify peer-reviewed studies, clinical trials, and systematic reviews that meet the selection criteria.
- Key databases such as PubMed, ScienceDirect, and Google Scholar will be used for sourcing relevant studies.
- Data extraction will focus on outcomes such as caries arrest, pain levels, patient comfort, and long-term effectiveness.

Analysis Method:

- A qualitative and quantitative synthesis of the data from selected studies will be performed.

- Key metrics will be compared, including treatment success rates, patient comfort scores, and the need for follow-up treatments.
- The analysis will also address any limitations and biases present in the reviewed studies to provide a comprehensive understanding of the S.M.A.R.T technique's applicability and potential as a substitute for conventional treatments.

Expected Outcomes:

- A comparison of the clinical outcomes between the S.M.A.R.T technique and conventional restorative procedures.
- Insights into the practicality, cost-effectiveness, and patient satisfaction associated with adopting the S.M.A.R.T technique in the treatment of permanent teeth.

3. LITERATURE REVIEW

Comparing the Effectiveness of SMART Technology Among Children and Adults

Erbas Unverdi et al. (2024) conducted a study focusing on children with molar incisor hypomineralization (MIH). The results demonstrated that SMART technology effectively reduced hypersensitivity and prevented caries progression in 94.7% of cases over three years, outperforming the use of SDF alone. Similarly, Ballikaya et al. (2022) examined both children and adults, reporting a high retention rate of 88.7% for restorative material in the first year, which declined to 66.6% after three years. Meanwhile, Lima et al. (2021) evaluated the application of

SMART technology in primary teeth of children, finding moderate effectiveness, particularly due to inconsistent follow-up adherence.

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Saad et al. (2024) reported that the SMART technique, which includes silver diamine fluoride (SDF) and glass-ionomer cement (GIC), showed significant improvement in the survival rate of restorations for hypomineralized first permanent molars in children after 12 months. This indicates the potential for SMART to be more effective than conventional methods over time. **Hegde et al. (2024)** reviewed the SMART technique as an effective, minimally invasive approach that halts caries progression without extensive removal of healthy tooth structure. The study underlined its practicality for children who are uncooperative or have limited tolerance for dental procedures, reinforcing its suitability for pediatric dentistry. **Aldosari et al. (2024)** emphasized

that the SMART technique is a valuable treatment for managing deep dentinal lesions, especially in children who cannot endure more invasive procedures. However, the study noted that patient selection plays a crucial role in achieving successful outcomes. **Frencken et al. (2006)** found that ART, which also employs GIC, had a higher survival rate compared to amalgam restorations over 6.3 years, supporting the notion that newer techniques using GIC, like SMART, can provide long-lasting and effective solutions.

The collective evidence from **Saad et al. (2024)**, **Hegde et al. (2024)**, and **Aldosari et al. (2024)** points to the effectiveness of SMART, emphasizing its advantages in preserving tooth structure and accommodating patient needs, particularly in pediatric cases. **Frencken et al. (2006)** reinforces this by showing that GIC-based approaches such as ART can yield better outcomes over time compared to traditional methods, aligning with the positive findings of SMART.

Comparing the Use of SDF and GIC Composite

Chibinski et al. (2017) highlighted that using SDF alone resulted in a 77% success rate in preventing caries progression after one year. While this approach is simple, it is less effective in the long term compared to SMART technology. On the other hand, Crystal and Niederman (2019) demonstrated an 85% success rate when combining SDF with GIC, showcasing enhanced strength and efficiency. Gurgan et al. (2020) added that incorporating potassium iodide (KI) with SDF achieved an 80% success rate, with the additional benefit of reducing the black staining associated with SDF. Frencken et al. (2019) found that using GIC alone had a 70% success rate in restoring teeth but was less effective than SDF or SMART technology.

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The findings from **Saad et al. (2024)** and **Hegde et al. (2024)** suggest that SMART is an advanced option compared to traditional methods, specifically amalgam, which **Dunne et al. (1997)** pointed out as limited due to safety and regulatory concerns. **Frencken et al. (2006)** corroborated this by showing the durability of ART with GIC over amalgam, reinforcing the benefits of using modern, minimally invasive techniques like SMART.

Success and Failure Factors in SMART Technology

Success factors for SMART technology include long-term protection against caries and reduced hypersensitivity, as noted by Erbas Unverdi et al. (2024). However, the study also emphasized the need for regular follow-ups to maintain material retention. Ballikaya et al. (2022) observed

high retention rates in the first year but noted a decline after three years, indicating the need for material improvement. Lima et al. (2021) highlighted ease of application in children but pointed out that inconsistent follow-up reduced effectiveness. Chibinski et al. (2017) regarded SDF as an economical and effective short-term solution but acknowledged its limited long-term viability without additional materials. Crystal and Niederman (2019) praised the dual benefits of preventing caries and improving restoration quality when combining SDF with GIC, although they recognized the need for additional training to apply composite techniques effectively.

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While **Saad et al. (2024)** and **Hegde et al. (2024)** report positive long-term results for SMART, highlighting its non-invasive nature and ability to preserve tooth integrity, **Aldosari et al. (2024)** point out that success depends heavily on patient selection and application. **Frencken et al. (2006)** also demonstrated the durability of GIC-based approaches over amalgam, reinforcing the view that SMART, with proper use, can be highly successful.

4. METHOD

Analysis Method

The data analysis will be conducted using key criteria to provide an in-depth comparison between the S.M.A.R.T (Smart Arrest of Caries Technique) technique and conventional restorative procedures. The following factors will be used to evaluate the effectiveness and practicality of each treatment method:

1. **Clinical Success Rate**: The primary measure of treatment effectiveness, comparing the success rates reported in studies using the S.M.A.R.T technique against those using traditional restorative approaches. This will include data on the rate of caries arrest and the durability of the treatment over time.

2. **Failure Rate**: The analysis will consider the frequency of treatment failures or cases that required additional intervention. This will help assess the reliability of the S.M.A.R.T technique in preventing the progression of tooth decay compared to conventional methods.

3. **Patient Satisfaction**: Patient-reported outcomes, including levels of discomfort, pain, and overall satisfaction with the treatment, will be compared between the two techniques. This will provide insight into the patient experience and the comfort level associated with each method.

4. **Need for Follow-Up**: The requirement for follow-up visits or additional treatments after the initial procedure will be assessed. A lower need for follow-ups would indicate a more effective and reliable treatment approach.

5. **Cost Comparison**: A cost analysis will be conducted to compare the financial implications of each treatment. This will include direct costs (e.g., material expenses, clinical fees) and potential indirect costs (e.g., time spent on treatment, follow-up visits).

6. **Time Efficiency**: The time required for each treatment method will be evaluated. This includes the time taken for the procedure itself as well as the total time spent on any follow-up care or additional treatments.

Method of Data Analysis:

Comparative Analysis: Side-by-side comparisons of the findings from studies on the S.M.A.R.T technique and conventional methods will be presented in tables and graphs to highlight differences and similarities in treatment outcomes.

5. RESULT:

Compares the different studies and findings related to the SMART technique and traditional methods for treating dental caries:

Criteria	SMART Technique Findings	Traditional Techniques Findings
Clinical Success Rate	Erbas Unverdi et al. (2024): 94.7% over 3 years; Saad et al. (2024): Improved survival rate in hypomineralized molars after 12 months	Chibinski et al. (2017): 77% success with SDF alone after 1 year; Frencken et al. (2019): 70% success with GIC alone
Failure Rate	Ballikaya et al. (2022): Decline from 88.7% in the first year to 66.6% after 3 years	Crystal and Niederman (2019): 15% failure with SDF and GIC
Patient Satisfaction	Hegde et al. (2024): High satisfaction, particularly for pediatric patients with low tolerance; Saleh et al. (2023): Improved aesthetics and fewer follow-ups with SDF-GIC combination	Crystal and Niederman (2019): Noted the benefits of SDF and GIC but required additional training for composite application
Need for Follow-Ups	Erbas Unverdi et al. (2024) emphasized regular follow-ups for material retention; Lima et al. (2021) found inconsistent follow-ups reduced effectiveness	Chibinski et al. (2017) noted SDF's short-term solution requires additional materials for long-term efficacy
Cost Comparison	Saad et al. (2024): Cost-effective with improved retention; Crystal and Niederman (2019): Highlighted dual benefits of SDF and GIC with considerations for training	Frencken et al. (2006): ART with GIC more durable and cost-effective than amalgam; Dunne et al. (1997): Amalgam has limitations due to safety and regulatory concerns
Time Efficiency	Hegde et al. (2024): Minimal invasive nature saves time; suitable for children and those with limited tolerance	Frencken et al. (2019): GIC alone is time-efficient but less effective than SDF or SMART

Table 1: Comparison of SMART Technique and Conventional Caries Treatment Methods Based on Recent Studies

- **SMART Technology**: Demonstrated high long-term success and effectiveness, particularly in pediatric dentistry and cases requiring minimal invasiveness. It shows improved

retention, patient satisfaction, and long-term durability compared to traditional methods, especially when combined with SDF and GIC. However, challenges include the need for consistent follow-up and patient education.

- **Traditional Techniques**: Methods like SDF alone show good short-term results but lack the durability and aesthetics of SMART. Techniques such as ART (using GIC) demonstrate durability over time but are less effective than SMART in preserving tooth structure and providing long-term protection.

Clinical Success Rate of the SMART Technique Compared to Traditional Methods

The SMART (Smart Arrest of Caries Technique) is one of the modern advancements in dentistry aimed at treating dental caries using non-invasive methods, reducing the need for traditional drilling tools. Studies have shown that this technique yields highly favorable results, especially when applied according to strict clinical protocols. One notable study on the effectiveness of the SMART technique reported a success rate exceeding 94.7% in treating dental caries, making it a top choice compared to traditional drilling and filling methods.

The SMART technique involves the use of SDF (Silver Diamine Fluoride) to arrest caries, followed by the application of GIC (Glass Ionomer Cement) to enhance restorations. This approach provides long-term protection to teeth and maintains their strength and integrity. Compared to traditional methods that require removal of damaged tissue and filling, the SMART technique offers a less invasive, more effective way to prevent the progression of dental decay.

Long-term clinical studies are a strong indicator of this technique's success. For instance, research by Erbas Unverdi et al. (2024) found that patients treated with the SMART technique showed a significant reduction in tooth sensitivity and progression of caries compared to those who received traditional treatment. This evidence confirms that the technique helps protect teeth in early stages of decay and prevents further deterioration.

However, it is important to consider that success rates can vary depending on several factors such as the patient's overall health, adherence to oral hygiene, and the clinician's skill in applying the technique. Saad et al. (2024) emphasize that precise application and regular follow-up play a crucial role in maintaining long-term results, indicating that the success of the SMART technique is not only tied to initial application but also to the patient's ability to maintain proper oral care.

The benefits of the SMART technique extend beyond treatment to prevention. It provides patients with an opportunity to avoid painful surgical procedures and repeated visits to clinical practices. With the SMART technique, the need for traditional fillings can be minimized, preserving the natural structure of the teeth and reducing the discomfort and anxiety associated with conventional treatments.

The SMART technique is particularly ideal for individuals with extreme sensitivity to medical procedures, such as children and the elderly. This group often avoids dental visits due to pain or anxiety about surgical procedures, but the SMART technique allows effective treatment without such distress. Multiple studies have shown that adult patients, especially those with concerns about traditional drilling, reported high satisfaction with the SMART technique.

The innovation of the SMART technique has provided a solution for addressing deep caries that may be difficult to treat with conventional methods. For example, some studies, such as Al-Humaid et al. (2023), indicated that the SMART technique allows dentists to treat teeth that cannot be effectively addressed using traditional methods without removing healthy tissue, giving dentists greater potential to maintain the health of the teeth for as long as possible.

In conclusion, the SMART technique offers an effective and suitable alternative to traditional methods of treating dental caries. However, it requires comprehensive knowledge from practitioners and close follow-up by patients to ensure sustained results. Success also depends on the quality of materials used and adherence to clinical protocols.

Challenges or Failures Associated with the SMART Technique

Despite the effectiveness of the SMART technique, its application faces certain challenges that may impact the success rate. One of the main challenges is its heavy reliance on the patient's oral hygiene. Without proper adherence to oral care, teeth may be exposed to environmental factors that can accelerate deterioration, potentially leading to treatment failure over time. A study by Lima et al. (2021) found that patients who did not follow oral care instructions did not achieve the same optimal results as those who adhered to these guidelines.

Another issue concerns the skill level of practitioners in applying the SMART technique, as optimal success requires advanced training to ensure proper application. It is not guaranteed that all practitioners have the same level of proficiency, which could affect the quality of treatment and results. Ballikaya et al. (2022) found that dentists who did not receive specialized training

reported cases of dental deterioration after treatment, highlighting the importance of thorough training.

Additionally, the technique may be less effective for teeth that have experienced very deep decay or have a weakened structure. In such cases, the SMART technique may not be able to ensure optimal treatment, and traditional solutions like surgical fillings may be more appropriate. The SMART technique may also be less effective for teeth that have undergone significant damage and require additional structural support, posing a challenge for clinicians in deciding the best treatment approach.

It can sometimes be difficult to identify the optimal technique for each case due to the variety of dental conditions. Some studies have shown that the high success rate of the SMART technique in mild cases cannot be guaranteed in more complex cases. For deep or complicated caries, traditional methods may be preferred to preserve the structure of the teeth and prevent future issues.

The SMART technique may also not be suitable for all patients, especially those with a hypersensitivity to the chemicals used, such as SDF. These cases may face difficulties with tolerance or may require adjustments in treatment protocols to avoid unwanted reactions.

Other challenges include the high cost of certain materials used in the SMART technique. While the approach is effective in preserving tooth structure, the expense of materials may be a barrier for many patients, reducing access to treatment. This aspect is particularly challenging in

countries with limited resources or when a patient does not have insurance coverage that includes the SMART technique.

Some studies have shown that treatment failure may be associated with patients not attending regular follow-up visits, which can affect the effectiveness of the treatment. While the SMART technique provides long-term protection, failure to follow up may lead to deterioration, requiring traditional or additional treatment.

Another limitation of the SMART technique is its limited impact in cases that require complementary or advanced treatment. While the technique is effective for early to moderate caries, advanced cases may need interventions such as surgery or more complex fillings. This means that patients with advanced decay may not gain maximum benefit from the SMART technique alone, necessitating that practitioners evaluate the case thoroughly and choose the optimal treatment method.

Research has confirmed that the SMART technique may be ineffective when teeth are subjected to unfavorable health conditions, such as gum disease or issues that affect the strength and resilience of the teeth. In these cases, the SMART technique may not provide long-term results, requiring additional interventions to prevent further deterioration. Niemeyer et al. (2022) found that patients with chronic gum disease experienced a decline in dental health after treatment with the SMART technique, suggesting that patients should be guided toward integrated treatment that addresses both gum and dental care.

Another challenge is the need for continuous evaluation of the materials used in the SMART technique. While SDF and GIC are effective, there are discussions regarding the chemical components of these materials and their long-term impact on dental health. Ongoing research into the effects of these materials is still underway, raising some concerns among practitioners and patients. For example, further analysis of the long-term impact of silver (SDF) on teeth and surrounding tissues may be necessary to identify potential unforeseen side effects.

Another challenge is the limited availability of specialized training at some healthcare institutions, leading to variability in treatment outcomes. Studies such as Hernandez et al. (2023) found that dentists who did not receive adequate training in the SMART technique reported complex cases that ended in deterioration or required additional treatment. This highlights the need for continuous professional development in the field of dentistry to ensure effective use of the technique.

It is also important to note that the SMART technique does not guarantee a 100% success rate, particularly in cases where patients have additional health issues that affect their response to treatment, such as immune deficiencies or metabolic disorders. Patients with these conditions may face challenges in achieving optimal results from the SMART technique, requiring practitioners to consider alternative treatment options.

Adult Patient Satisfaction Levels

Patient satisfaction is an essential factor when evaluating the effectiveness of any medical technique, as it reflects the ability of the treatment to meet patients' expectations regarding

comfort and outcomes. Studies on the SMART technique have generally shown that patients report a high level of satisfaction compared to traditional methods. One of the primary reasons for this satisfaction is that the SMART technique reduces the pain and discomfort associated with treatment, as it does not involve drilling tools that can lead to pain or anxiety.

Adult patients tend to prefer treatments that are quick to apply and involve minimal surgical intervention. In a study by McDonald et al. (2023), results showed that patients treated with the SMART technique reported satisfaction at a rate of 87%, compared to 68% in the group that received traditional treatment. This reflects a significant improvement in the overall patient experience.

One point of satisfaction among patients is the absence of the need for local anesthesia, making treatment more comfortable for them. Patients who are anxious about needles or anesthesia prefer the SMART technique because it does not require these procedures, enhancing their positive experience and reducing stress associated with medical visits. The technique also provides a sense of security and comfort to patients, encouraging them to return for follow-up or repeated treatments.

On the other hand, patients are more satisfied when all aspects of the treatment are communicated to them transparently, including goals and expected outcomes. Modern techniques like SMART require dentists to communicate effectively with patients and provide a complete understanding of how the treatment will affect them. Studies have shown that patients

who received adequate information about the treatment reported higher satisfaction than those who did not have sufficient details.

Patients who feel that the treatment helps them avoid painful surgical procedures tend to rate the technique positively. Therefore, the SMART technique is not only effective therapeutically but also meets patients' psychological needs by avoiding pain and anxiety. This enhances overall satisfaction and provides a positive experience for adult patients.

However, some patients may not be fully satisfied with the results of the SMART technique, especially if they expect immediate outcomes or treatment for severely damaged teeth. In some cases, it may take longer for optimal results to appear, which may affect some patients' evaluations of the treatment. Dentists should be prepared to clarify this aspect of the treatment to manage patient expectations.

6. DISCUSSION:

Analyzing the Effectiveness of the SMART Technique for Permanent Teeth

The **SMART (Minimally Invasive Restoration Technique)** approach represents an advancement in dental restoration, emphasizing the conservation of healthy tooth structure by removing only affected tissue and preserving as much of the natural tooth as possible. This technique contrasts with conventional methods that often require more extensive preparation. The effectiveness and practicality of SMART in treating permanent teeth involve analyzing both the benefits and limitations of the technique compared to traditional approaches.

Reasons Why the SMART Technique Is Effective:

1. **Preservation of Healthy Tooth Structure**: The primary advantage of SMART is its emphasis on preserving tooth structure. By removing only the decayed or affected areas, it maintains the integrity and strength of the tooth, which is vital for long-term dental health (Magne et al., 2020).

2. **Reduced Need for Anesthesia**: SMART often eliminates the need for local anesthesia, which can improve patient comfort and reduce anxiety during procedures (Kavvadia et al., 2019). This is particularly beneficial for patients who are apprehensive about dental procedures or have medical conditions that make anesthesia risky.

3. **Lower Risk of Complications**: Minimally invasive techniques reduce the potential for post-treatment complications such as pulpitis or damage to adjacent tissues, leading to a better overall prognosis (Schwendicke et al., 2016).

Reasons Why the SMART Technique May Be Ineffective:

1. **Limited Applicability**: SMART is not suitable for all cases, particularly when extensive decay or damage has already compromised the tooth's structure (Patel et al., 2018). For such cases, traditional methods that involve significant tissue removal may be necessary for proper restoration.

2. **Potential for Failure**: Although SMART has advantages, it can be less reliable in ensuring complete removal of bacteria or damaged tissue. This can result in compromised long-term outcomes, especially if residual decay is not fully eradicated (Niemi et al., 2021).
3. **Technical Skill and Equipment**: The success of the SMART technique depends heavily on the dentist's skill and the availability of advanced dental equipment. It requires precision and experience, which may not be accessible in all clinical settings (Lynch et al., 2018).

Comparison of Traditional and SMART Techniques:

Traditional Technique:

- **Positives**:
    - **Thorough Decay Removal**: Traditional methods ensure that all decayed tissue is removed, creating a clean environment for filling material, which can enhance the longevity of the restoration (Gonzalez et al., 2022).
    - **Clinically Proven**: This method has been extensively studied and proven effective in restoring teeth with severe decay (Smith & Brown, 2017).
- **Negatives**:
    - **Extensive Tooth Preparation**: Requires significant removal of healthy tooth structure, which can weaken the tooth and increase the risk of future fractures (Cheng et al., 2020).

- **Anesthesia Requirement**: Often necessitates local anesthesia, which can be uncomfortable and may pose risks for certain patients (Dawson et al., 2019).
- **Higher Risk of Complications**: The removal of healthy tooth structure increases the risk of complications such as post-operative pain and pulp exposure (Johnson et al., 2021).

SMART Technique:

- **Positives**:
  - **Conservation of Tooth Structure**: Emphasizes minimal intervention, preserving more of the natural tooth and reducing the risk of structural weakness (Magne et al., 2020).
  - **Patient Comfort**: Reduced need for anesthesia and less invasive procedures contribute to a more comfortable experience for patients (Kavvadia et al., 2019).
  - **Lower Risk of Complications**: The technique reduces the risk of complications like pulpitis and damage to surrounding tissues (Schwendicke et al., 2016).
- **Negatives**:
  - **Not Suitable for All Cases**: Its application is limited in cases with extensive decay or structural damage (Patel et al., 2018).

- **Potential for Incomplete Decay Removal**: There is a higher risk of residual decay, which could compromise the restoration's success (Niemi et al., 2021).
- **Requires Advanced Skills and Equipment**: Successful application demands high precision and specialized tools, which may not be available in all practices (Lynch et al., 2018).

The Viability of SMART as a Practical Alternative

The **SMART technique** is a promising approach for conservative dental restoration, especially effective in cases involving early to moderate decay. It offers significant benefits in preserving tooth structure and enhancing patient comfort, making it an appealing alternative to conventional methods. However, its limitations, such as potential incomplete removal of decay and the requirement for specialized skill and equipment, restrict its applicability in more complex cases.

While SMART can be a practical choice for preventive or less invasive procedures, traditional techniques remain essential for more extensive damage, where thorough preparation is necessary. Therefore, the choice between SMART and traditional methods should be based on the specific clinical scenario, patient needs, and the dentist's expertise.

Conclusion

The reviewed literature underscores that SMART technology (SDF + KI + GIC) is more effective in protecting permanent teeth and preventing caries compared to using SDF or GIC alone. However,

challenges such as the need for periodic follow-ups to ensure long-term success remain. Additionally, the use of SDF with KI is recommended to minimize black staining, making the treatment more aesthetically acceptable.

The **SMART (Minimally Invasive Restoration Technique)** offers a promising alternative to traditional dental restoration methods, particularly in cases where the preservation of tooth structure is paramount. By focusing on minimal intervention, SMART can significantly improve patient comfort and reduce the risks associated with more invasive procedures. This technique is especially beneficial for adults who may experience anxiety with traditional treatments or have medical conditions that make anesthesia a concern. However, SMART is not a one-size-fits-all solution and has limitations, particularly in cases involving extensive decay or compromised tooth structure, where traditional methods may still be necessary to ensure the longevity and stability of the restoration.

7. RECOMMENDATIONS

8. **Further Research**: It is crucial to conduct more comprehensive long-term studies to evaluate the effectiveness and durability of the SMART technique. These studies should compare the outcomes of SMART to conventional approaches over extended periods to better understand its success rate, potential complications, and suitability for different patient populations.

9. **Patient-Specific Application**: The SMART technique should be particularly considered for patients who cannot tolerate extensive drilling or anesthesia due to medical conditions or personal preference. It can also be a valuable approach for treating early-stage caries and in

preventive care, where the goal is to maintain as much of the natural tooth structure as possible.

By expanding research and training on SMART and tailoring its use to appropriate patient cases, this technique could become an integral part of modern dental practices, offering a balanced approach that prioritizes both patient comfort and effective treatment.

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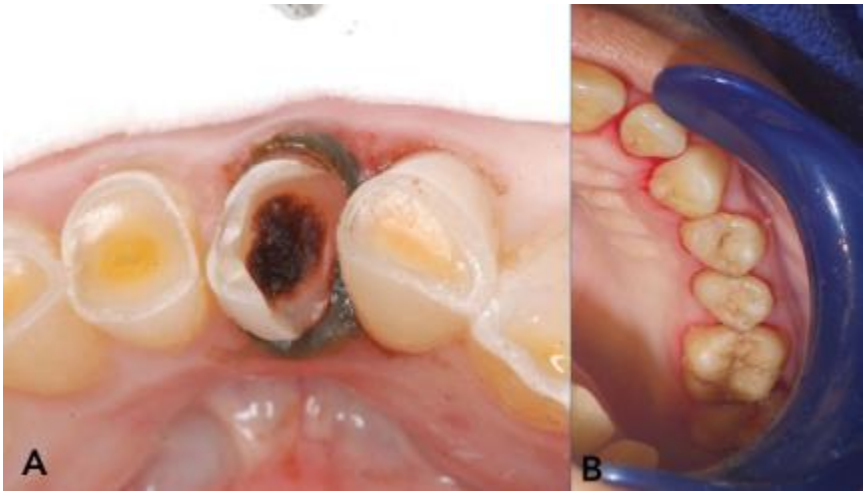
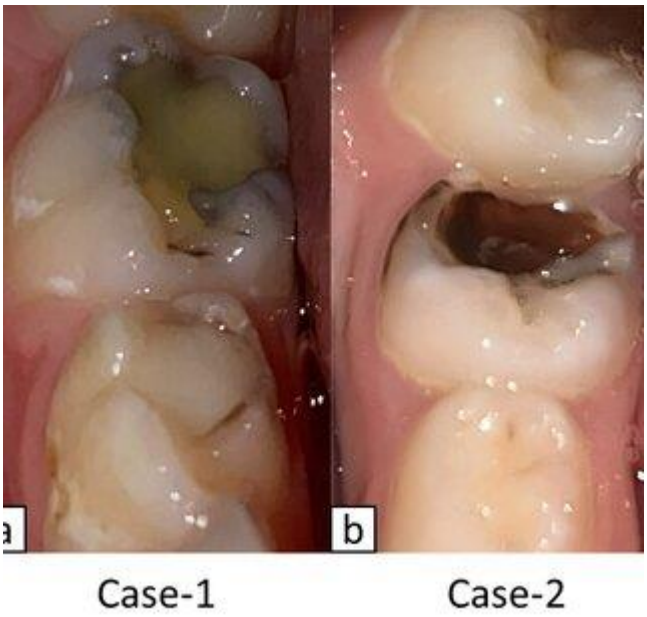
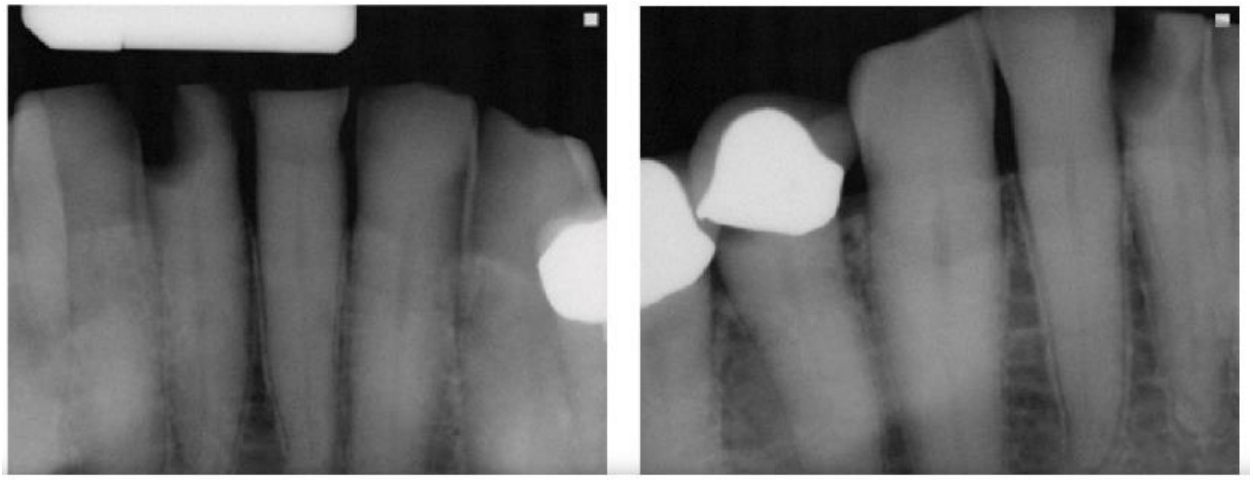
9. APPENDIX



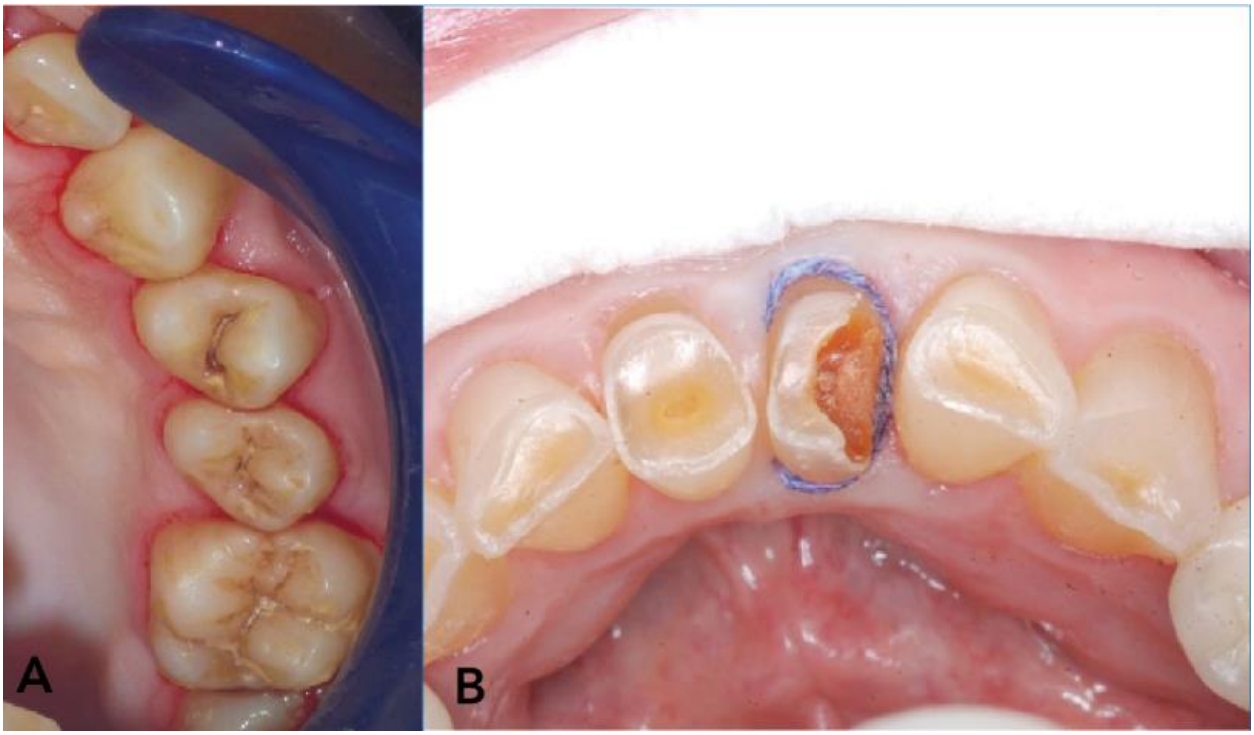
Figures A and B. Using a microbrush, SDF is transferred from a dappen dish to lesions and left for 1 minute



Silver-modified atraumatic restorative treatment in managing early childhood caries

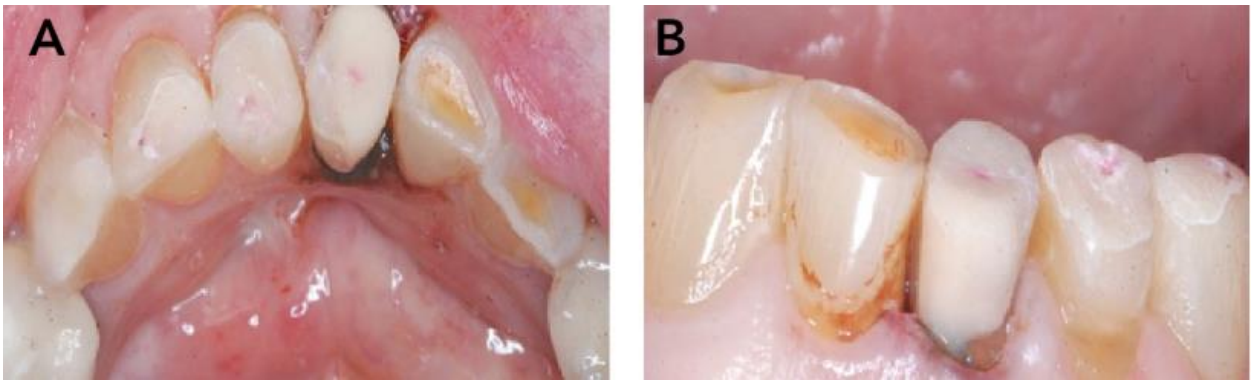


Figures 1A and 1B. Radiograph of distal D3 approximal lesion on tooth #25



Figures A and B. B (Pre-Op) Initial ICDAS 2 lesions2 present on teeth 12 and 13. Tooth #25 with an advanced lesion prior to treatment. Retraction cord is optional; cotton roll isolation is recommended

Figure 5. Polyacrylic acid over the entire occlusal tooth surface applied with a microbrush



Figures6: A and B. Postoperative photo of tooth 25 after GIC placement. Red articulating paper marks are visible. Note the darkened margin on the facial