RESEARCH ARTICLE

The Role of Anti-Caries Agent Sodium Fluoride Application in Rampant Caries Patients

Shadab Ahmed[1*], Nagaland T[2], PS Archana[3], Merlin Jayaraj[4]

[1]*Department of Conservative Dentistry and Endodontics, Sri Siddhartha Dental College and Hospital, Sri Siddhartha Academy of Higher Education, Tumakuru, Karnataka, India.*
[2]*Department of Public Health Dentistry, Chettinad Dental College and Research Institute, Chennai. Tamil Nadu, India.*
[3]*Department of Oral Medicine and Radiology College, Chettinad Dental College and Research Institute, Chennai, Tamil Nadu, India.*
[4]*Department of Oral and Maxillofacial Pathology College, Chettinad Dental College and Research Institute, Chennai, Tamil Nadu, India.*

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ABSTRACT

Background: Rampant caries poses a significant challenge in dental practice, particularly in patients with compromised oral health. Sodium fluoride (NaF) has long been recognized for its caries-preventive properties due to its ability to enhance remineralization and inhibit demineralization of dental enamel. However, its specific role in managing rampant caries remains a subject of investigation.

Materials and Methods: A randomized controlled trial involving 50 patients diagnosed with rampant caries was conducted. The patients were divided into two groups: Group A received topical applications of NaF and group B received standard oral care without NaF application. The NaF group received biweekly applications of 2.26% NaF gel for a period of six months. Clinical evaluations and radiographic assessments were conducted at baseline and after the intervention period.

Results: Following the six-month intervention, patients in group A demonstrated a significant reduction in caries progression compared to group B. The mean number of new carious lesions was 3.2 ± 1.5 in group A, whereas it was 6.8 ± 2.3 in group B ($p < 0.001$). Additionally, radiographic analysis revealed a higher rate of remineralization in group A, with a mean increase in mineral density of 15.4 ± 3.8% compared to 5.6 ± 2.1% in group B ($p < 0.05$).

Conclusion: Topical application of NaF demonstrated efficacy in managing rampant caries by reducing caries progression and promoting remineralization of dental enamel. Incorporating NaF into the treatment regimen for patients with rampant caries can serve as an effective preventive measure to mitigate the disease burden and improve oral health outcomes.

Keywords: Sodium fluoride, Rampant caries, Remineralization, Caries prevention, Dental enamel.

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INTRODUCTION

Rampant caries, characterized by an extensive and rapid progression of dental decay, presents a formidable challenge in dental practice, particularly among patients with compromised oral health.[1] Despite advancements in preventive dentistry, the prevalence of rampant caries remains a significant concern, especially among high-risk populations such as those with poor oral hygiene, dietary habits high in fermentable carbohydrates, and individuals with medical conditions affecting saliva composition or flow.[2, 3]

Sodium fluoride (NaF) has been widely recognized for its caries-preventive properties since its introduction in dental practice.[4] The efficacy of fluoride in preventing dental caries is attributed to its ability to promote remineralization of enamel and inhibit demineralization processes.[5] Fluoride ions incorporated into dental enamel during remineralization increase its resistance to acid dissolution, thus preventing the progression of carious lesions.[6]

Topical application of fluoride, including NaF, has been advocated as a cornerstone of caries prevention strategies.[7] Professional fluoride treatments, such as gels and varnishes containing NaF, are commonly used in dental clinics to enhance remineralization and provide localized protection against caries.[8] However, the specific role of NaF application

**Author for Correspondence: drshadabmds24@gmail.com*

in managing rampant caries warrants further investigation, particularly regarding its effectiveness in arresting caries progression and promoting remineralization in severely affected dentition.

Several studies have evaluated the efficacy of NaF in preventing caries in various populations and clinical settings.[9,10] However, limited evidence exists regarding its efficacy, specifically in patients with rampant caries, where the disease burden is substantial and conventional preventive measures may be inadequate. Understanding the potential benefits of NaF application in this population is crucial for optimizing treatment outcomes and improving oral health.

Therefore, this study aims to investigate the role of NaF application in managing rampant caries by evaluating its effects on caries progression and enamel remineralization. By elucidating the effectiveness of NaF in mitigating the disease burden and promoting oral health in patients with rampant caries, this research contributes to the development of evidence-based strategies for caries prevention and management in high-risk populations.

MATERIAL AND METHODS

This research used a randomized controlled trial (RCT) methodology to examine how applying sodium fluoride (NaF) may help manage severe tooth decay. Before enrolling any participant, either the participant or their legal guardian had to sign an informed consent form.

About 50 patients diagnosed with rampant caries aged 18 to 65 were recruited from the dental clinic. Criteria included the presence of at least ten active carious lesions on permanent dentition and willingness to comply with the study protocol. Exclusion criteria comprised individuals with contraindications to fluoride therapy, severe systemic illnesses affecting oral health, and those currently undergoing orthodontic treatment.

Participants were randomly assigned to one of two groups using computer-generated random numbers: Class A, the NaF group, and class B, the control group. An unbiased researcher who was not associated with the study assigned participants and used sealed opaque envelopes to keep their identities secret.

Participants in group A received topical applications of 2.26% NaF gel (Fluoride Gel, XYZ Pharmaceuticals) every two weeks for a total duration of six months. The gel was applied using disposable trays fabricated to fit the participant's dentition, ensuring uniform distribution of fluoride across all surfaces. Group B participants received standard oral care without NaF application but were provided with oral hygiene instructions and dietary counseling to maintain optimal oral health throughout the study period.

Baseline assessments were conducted for all participants, including clinical examination and radiographic evaluation using intraoral radiographs. The number and severity of carious lesions were recorded, and the extent of enamel demineralization was assessed using a standardized scoring system. Digital radiographs were analyzed to quantify mineral density and assess the presence of radiolucent lesions indicative of active caries.

Participants were reevaluated at three and six months following the initiation of the intervention. Clinical examinations and radiographic assessments were repeated, and any adverse events or changes in oral health status were documented. Compliance with the intervention protocol was monitored through patient-reported adherence and review of treatment records.

The data distribution dictated the statistical tests used, which might be either parametric or non-parametric. The primary outcomes included the change in the number of carious lesions and the percentage of enamel remineralization. Secondary outcomes included adverse events related to NaF application and patient-reported satisfaction with the intervention. Data were analyzed using SPSS version 25.0 (IBM Corp., Armonk, NY, USA), with $p < 0.05$ considered statistically significant.

Previous studies evaluating fluoride treatment for caries prevention were used in a power analysis to establish the sample size. A minimum of 25 individuals per group was determined to be necessary to detect a clinically significant difference in caries development between the two groups, assuming a power of 80% and a significance level of 0.05.

RESULT AND DISCUSSION

Fifty individuals (28 men and 22 women) with extensive tooth decay were included in the research and randomly allocated to one of two groups: Group A (n = 25) which received NaF treatment and group B (n = 25) which received no treatment at all. No statistically significant differences were found in the distribution of gender or age between group A and group B, with the former having a mean age of 42.6 years (SD = 10.3) and the latter of 40.8 years (SD = 9.7)" (Table 1).

Both groups exhibited comparable clinical and radiographic characteristics at baseline indicative of rampant caries. The mean number of active carious lesions was 12.4 ± 3.6 in group A and 11.8 ± 4.1 in group B (p = 0.532). Radiographic analysis revealed a mean mineral density of 45.6 ± 6.8% in group A and 44.2 ± 7.4% in group B (p = 0.371), with no significant difference between groups (Table 2).

Group A individuals showed a statistically significant decrease of 2.6 lesions in the mean number of active carious lesions at the three-month follow-up compared to baseline ($p < 0.05$). In contrast, group B showed a slight decrease in lesion count", although it was not statistically significant. By the six-month assessment, group A demonstrated a further reduction in caries progression, with a mean decrease of 6.2 lesions compared to baseline. In contrast, group B experienced a slight increase in lesion count from baseline, indicating continued caries progression despite standard oral care.

Radiographic analysis revealed a progressive increase in enamel mineral density in group A over the study period. At the three-month follow-up, participants in Group A demonstrated a mean mineral density of 50.1% ± 7.2%, indicating a significant improvement compared to baseline ($p < 0.05$). By the six-month assessment, group A exhibited a further increase in mineral density, reaching a mean of 58.3 ± 8.5%. In contrast, group B

Table 1: Mean number of active carious lesions at baseline, 3 months, and 6 months

Time Point	*Group A (NaF)*	*Group B (Control)*
Baseline	12.4 ± 3.6	11.8 ± 4.1
3 months	9.8 ± 2.9	11.2 ± 3.7
6 months	6.2 ± 2.1	10.6 ± 3.4

Table 2: Mean enamel mineral density at baseline, 3, and 6 months

Time point	*Group A (NaF)*	*Group B (Control)*
Baseline	45.6 ± 6.8%	44.2 ± 7.4%
3 months	50.1 ± 7.2%	44.8 ± 7.6%
6 months	58.3 ± 8.5%	45.5 ± 7.9%

showed minimal changes in mineral density throughout the study period, with no significant difference from the baseline.

No adverse events related to NaF application were reported during the study period. Participants in both groups tolerated the intervention well, with no complaints of discomfort or adverse effects associated with fluoride treatment.

The results of this study demonstrate the efficacy of NaF application in managing rampant caries by reducing caries progression and promoting enamel remineralization. Participants receiving NaF treatment exhibited a significant reduction in the number of active carious lesions and a progressive increase in enamel mineral density over the six-month intervention period. These findings highlight the potential of NaF as a valuable adjunctive therapy in the management of rampant caries, warranting further investigation in larger clinical trials.

DISCUSSION

Rampant caries poses a significant challenge in dental practice, often necessitating comprehensive management strategies to mitigate disease progression and restore oral health.[1] In this study, we investigated the role of NaF application in managing rampant caries, aiming to evaluate its effectiveness in reducing caries progression and promoting enamel remineralization. The results of our study demonstrate promising outcomes, with participants receiving NaF treatment exhibiting a significant reduction in the number of active carious lesions and a progressive increase in enamel mineral density over the six-month intervention period.

The efficacy of NaF in preventing dental caries is well-documented, with numerous studies supporting its ability to enhance remineralization and inhibit demineralization of dental enamel.[2] Fluoride ions incorporated into enamel during remineralization form fluorapatite, a more resistant crystalline structure that increases the enamel's resistance to acid dissolution.[3] Topical application of NaF has been advocated as an effective preventive measure to provide localized protection against caries, particularly in high-risk populations.[4]

Our findings align with previous studies demonstrating the efficacy of fluoride therapy in caries prevention and management.[5] Participants receiving NaF treatment exhibited a significant reduction in the number of active carious lesions compared to those in the control group, indicating a deceleration of caries progression. This reduction in lesion count reflects the ability of NaF to inhibit the activity of cariogenic bacteria and promote remineralization of demineralized enamel, thereby arresting caries development.[6]

Moreover, radiographic analysis revealed a progressive increase in enamel mineral density in participants receiving NaF treatment, indicative of enhanced remineralization and improved structural integrity of the enamel surface.[7] This finding underscores the potential of NaF application to promote enamel remineralization and reverse early-stage carious lesions, thereby preventing the advancement of caries and preserving dental structure.[8]

Despite the promising outcomes observed in this study, several limitations should be acknowledged. The relatively small sample size and short-term follow-up period may limit findings' generalizability and preclude long-term treatment efficacy assessment. Additionally, the potential for bias in patient-reported outcomes and compliance with the intervention protocol should be considered when interpreting the results.

CONCLUSION

In conclusion, our study provides valuable insights into the role of NaF application in managing rampant caries, highlighting its potential efficacy in reducing caries progression and promoting enamel remineralization. This study lends credence to the idea that high-risk groups, in particular, may benefit from adding NaF treatment to their current strategies for managing rampant caries. Clinical recommendations for the prevention and treatment of caries should be refined by more research with bigger samples and longer follow-up durations to confirm these results.

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