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Topical Effect of Silver Diamine Fluoride in Preventing and Arresting Root Caries in Elderly Patients.

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Abstract

Aim of the study: The purpose of the present investigation was to see how efficient silver diamine fluoride (SDF) solution treatment to prevent dental root caries.

Materials and method: This research was done at Iraq's geriatric facilities. Forty seniors with active caries lesions were fortuitously assigned into two groups: Group 1 (placebo control)—doubles Twice-Annual treatment with soda water; Group 2—Doubles Twice-Annual treatment with silver diamine fluoride solution.

Results: After 18 months, the arrest rates of root caries were 28 percent in group1 (control) and 88 percent group 2 silver diamine fluoride solutions (x2 test, $p < 0.05$). There was a considerable relation (dependent) between silver diamine fluoride and stopping root surface dental caries Chi=7.08, df=2**,** P<0.05, which means that silver diamine fluoride was efficient in stopping dental caries while there was no relation (independent) between placebo dye and arresting caries, Chi=1.33 df=2 P>0.05.

Conclusions: Silver diamine fluoride solution was helpful in avoiding root caries in elderly people who do not have access to fluoridated water.

Keyword: - silver diamine fluoride, elderly patient.

Introduction

Dental caries is the world's widespread pandemic, affecting a huge part of the global population disregarding gender, age, or race (1). It is reasonable to assume that about 2.5 billion (35 percent) of the world's population has ignored caries in their fixed teeth (2). A number of evidence-based caries avoidance methods were described; however, such

approaches necessitate considerable financial and substructure investment and are highly dependent on the accessibility of oral health workers available (3).

Individuals over the age of 60 are more likely than others to develop root caries, with rates ranging from 12 to 77 percent. Aging and poor oral health, as well as periodontal disease, are all risk factors (4). The frequency of root caries in the elderly correlates to a peak in neglected dental caries in the worldwide adult population at about 70 years of age, resulting in a significant financial burden on the social welfare system (5). Ignored dental caries has a significant negative impact on the quality of life of the elderly, particularly because of the pain it causes, which can cause psychological and physical distress as well as social isolation (6). Root caries lesions are becoming more common due to a number of reasons (7). In the first place, gingival recession exposes root surfaces, which are more vulnerable to bacterial adhesion and demineralization than enamel surfaces according to the American Dental Association (8, 9, and 10). Second, elderly people have lower salivary flow and are less able to maintain good dental hygiene. Third, as a result of population growth, the senior population in nursing care is increasing, with a lot of people who are not capable to undertake oral hygiene regularly(through teeth brushing) themselves, and nursing staff tooth brushing is frequently insufficient (11-14).

All of these reasons demand the availability of effective and easy preventative regimens (10), as well as the management of occurring root caries lesions. In addition, because positioned restorations have a limited lifespan, this treatment cannot be limited to restorative procedures alone (15), and older patients are also limited in their mobility, making even non-conventional restorations difficult to deliver. As a result, non-restorative treatment alternatives are required, allowing root caries lesions to be controlled in non-dental settings (12). Caries lesions on the root surfaces of the teeth of the elderly can cause discomfort and tooth loss, as well as have a detrimental influence on their overall health. Therefore, it is critical to develop low-cost and effective treatment methods for controlling these lesions (13, 14).

Topical fluoride may be a beneficial technique to arrest caries lesions based on preventive dentistry since fluoride in several forms was demonstrated to be efficient in dental caries prevention (16).

A new fluoride compound, silver diamine fluoride, has emerged as one of the most recent in the family (SDF). A 38 percent SDF solution with 44,800 parts per million (ppm) fluoride was used to prevent cavities. (17). A squamous layer of silver-protein conjugate is formed on the decaying surface of a tooth as a result of the administration of SDF, which enhances the tooth's resistance to acid breakdown and enzymatic digestion (18). When a lesion is treated, its mineral density and roughness increase, although its depth reduces as a result of the treatment (13). With their ability to dissolve cell membranes, denature proteins, and inhibit DNA replication, silver ions fight directly against the bacteria that cause dental caries (14, 17). Silver and fluoride ions can permeate enamel up to 25 and dentin up to 50–200μ (16, 18). Silver is accessible for antibacterial activity, and fluoride promotes remineralization. SDF was proven to be efficient in preventing and stopping dentin caries in initial teeth of children (19-21), and is now indicated for avoiding and stopping root caries lesions (22, 23).

The importance of anti-caries agents like SDF is likely best appreciated in context of the "World Health Organization's (WHO) Millennium Development Goals for Health". including oral health (24). The recommended strategy for accomplishing these objectives is to provide a fundamental oral health package that includes emergency treatment, preventive, and cost-efficient therapies in that sequence (25). This study evaluated the essential data on the usefulness of SDF in avoiding and stopping caries in older individuals, with an emphasis on enhancing dental health among the elderly, including avoiding new root caries and stopping current active root caries. SDF, if proved to be successful, might have a substantial impact on this group, particularly in areas where dental treatment is inaccessible or unavailable, or in elderly who refuse to comply with regular dental operations (25, 26).

Method

The impacts of SDF on root caries in the elderly were compared to a placebo in this study. The study was approved by the department of orthodontic, pedodontic and preventive dentistry, Dentistry Department, Dijlah University, IRAQ. A double-blind, randomized, placebo-demonstrated experiment with two parallel groups was used in this investigation. Sixty elderly patients were randomly assigned to receive topical applications of 38 percent SDF Silver diamine fluoride (38 percent w/v Ag (NH3)2F, 30 percent w/w), which is a colorless topical agent made up of 24.4-28.8 percent (w/v) silver and 5.0-5.9 percent fluoride and is bought as "Advantage Arrest TM by Elevate Oral Care, LLC (West Palm Beach, FL)".

The study was followed for 18 months, with reapplication each six months after baseline via the similar examiner. Patients at private dental clinics aged 60 to 72 years old made up the majority of the participants. The research was carried out from April through October of this year. Due to significant cognitive or physical impairments, the patients who were chosen were unable to do routine oral hygiene (tooth brushing) on their own, and they were also unable to tolerate traditional restorative therapy. Elders whose salivary gland function had been severely harmed in the head and neck area due to illness, medication, or treatment such as radiation were excluded. Before the study began, written informed consent was acquired. During the inspection, disposable dental mirrors and blinded dental probes were employed, and disposable micro brushes were used to paint SDF on the damaged or exposed root surfaces without any caries excavation. The exposed root surfaces of each natural tooth were examined to determine their overall condition. Plaque and calculus that was impeding visual inspection of the root surfaces were removed with the help of cotton buds and other hand instruments. Visual-tactile testing indicated the presence of a root caries lesion and the activity level of the lesion. It was determined that active caries had been discovered when a blind probe with light force could penetrate the lesion surface with ease. If the lesion surface was firm and smooth, inactive (arrested) caries was observed. Root caries is defined as a caries lesion that extends beyond the cementum-enamel junction by at least 1 mm. The participants, examiners, and dental practitioners who applied the treatments were all blinded. The test and comparative liquids were dispensed from identical bottles to preserve blindness. Codes A, B were allocated to the test and placebo bottles. The biostatistician only knew which two labels were identical, but she was unaware of whether

labels were test or placebo. Following the baseline assessment, individuals who met the study's eligibility requirements were assigned to one of two groups employing block randomization. A disposable micro brush was used to paint soda water with a bitter flavor onto root surfaces with active caries in Group 1 as a placebo control. In Group 2, active caries lesions were painted with a 38 percent SDF solution (Saforide, Toyo Seiyaku Kasei Co., Ltd., Osaka, Japan). Cotton rollers were employed to separate the teeth from saliva in both procedures. Petroleum jelly was used to protect the tooth's gingival tissue. The drug was put into an applicator and 3–4 mg was administered to the lesion (1 drop treats one tooth). Following application, no rinse was used, and no additional instructions were given. The SDF solution was applied to the root surface for 2 minutes. After six, twelve, and eighteen months, the operations were repeated. The study was followed for 18 months, with the same examiner doing clinical examinations and reapplications every 6 months after baseline. All of the exams were conducted using the same equipment and using the same diagnostic criteria. The term "arrested root caries" was coined to describe a situation in which an active root caries lesion diagnosed at baseline remained inactive during follow-up.

Result

The whole 60 senior patients were involved in the study, including twenty-six (43 percent) women and thirty-four (56.5 percent) males (table 1). Their ages ranged from 60 to 72. Since all of the participants are still being followed up on, the therapy was maintained on 60 older people. The 60 elderly were split into two groups, with 25 receiving placebo (liquid A) and 35 receiving silver diamine fluoride (liquid B). A total of 28.5 percent of decayed teeth with hard halted dentine were found in the SDF group after six months of follow-up, whereas the placebo group had only 12 percent ($p< 0.05$). Following up after a year revealed that the SDF group had 65.7 percent of the cavities arrested whereas the control group only had 20% ($p<0.001$). and following up after eighteen months revealed that the SDF group had 88.5 percent of the cavities stopped, whereas the controlled group had just 28 percent ($p< 0.05$). Comparing the controlled placebo group, which showed no convert in stopped caries activities, the preventive fraction indicated that using SDF reduced dental caries from 28.5 percent to 88.5 percent. SDF has a significant (dependent) relationship with arresting root surface dental caries $Chi=7.08$ $df=2$, $P <0.05$, indicating that SDF is effective in stopping dental caries, whereas placebo dye has no such relationship (independent) with arresting caries $Chi=1.33$ $df=2$, $P>0.05$, indicating that placebo dye is ineffective in stopping dental caries (table 2).

Discussion

Although dental root caries is a common dental illness among the elderly throughout the world, and its prevalence increases with age (1), the high incidence of untreated caries may be explained by a lack of oral health education, infrequent tooth brushing, and a lack of participation in preventative dental care services among the elderly (2, 8, 27). Because progressed root caries can lead to discomfort, tooth loss, and have a negative influence on overall health, there is a need to create low-cost, high-effective therapeutic methods to administer ignored caries lesions on root surfaces in the elderly (24, 27). Topical fluoride administration is a less invasive therapeutic option that might be a viable alternative to surgery (28, 29). Surface silver diamine fluoride is a clear liquid that stops the lesion by coloring it on the decaying surface in milligram quantities (20, 30). The treated lesion improves the density of the minerals and hardness of the hardened surface while decreasing in depth (13). Applied to a decaying surface, silver diamine fluoride induces the development of an extracellular layer of silver-protein conjugates, which enhances the surface's resistance to acid dissolution and bacterial enzymatic digestion (19). Silver and fluoride ions can permeate enamel up to 25 microns and dentin up to 50–200 microns (13, 16). By dissolving the cell membrane, denaturing proteins, and blocking DNA replication, silver ions halt the progress of whole studied oral bacteria that are directly active against the bacteria in caries (14, 17). Fluoride promotes remineralization by deposition of calcium fluoride, which has caries- protective effect (13) and after re-acidification, silver is accessible for antibacterial activity (14, 17).

This suggests that using a topical 38 percent SDF solution to stop active dental root caries in community-dwelling older individuals in a non-fluoridated region is beneficial. In the SDF group, the proportion of active root caries lesions that had become arrested was 3.1 times greater than in the control group 18 months after the start of the study. Concerning other factors, including the elder's education level, the avoidance of snacking habits, proper tooth brushing, and the adoption of further tooth cleaning aids, can, on the other hand, explain the simple halt in dental caries in the placebo group who used different oral hygiene measures and dietary habits. In comparison to the placebo group, the SDF group saw a much reduced increase in new caries (26, 31).

A number of other studies involving SDF in clinical trials on preventing dentin caries in primary teeth of preschool children discovered that biannual application of SDF was more effective than annual application (20, 21), and that in young children, the frequency of application of SDF solution used once a year was found to be more effective than biannual application. (20, 21) (19, 32). The frequency with which SDF solution is used in the treatment of active root caries in elderly individuals increases with increased usage of the solution. A single treatment does not appear to be adequate for long-term benefits, but reapplication every six months resulted in considerable success and better effects than an annual application. Depending on the length of their following-up, we were capable to display that the avoidance impact of SDF in root surfaces appears to develop with raising period of therapy (22, 23).

Biennial 38 percent SDF treatments to revealed root surfaces of older people are successful against dental caries initiation and advancement, owing to SDF's capacity for both avoidance and stopping of dental caries, as well as its low cost and convenience of

administration. Because this is a novel subject, it will require further research in the future. In the present investigation, it must be referred to that the water in Iraq is not fluoridated, and that topical application of SDF solution is equally efficient in stopping root caries among elderly people who live in fluoridated regions; this requires to be examined in further clinical investigations, and more research is also needed to know the effectiveness of other fluoridated products in arresting root caries.

Conclusion

Silver diamine fluoride had a significant preventative effect on root caries in elderly people who lived in non-fluoridated area

Conflicts of Interest

The author reported that there is no conflict of interest.

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Table 1: Distribution of patient (number and %) according to gend

Gender	NO.	%	NO.	%	Total	%
Male	20	33.3%	14	23.3%	34	56.6%
female	15	25%	11	18.3%	26	43.3%
Total	35	35%	25	41.6%	60	100%

Table 2: Arrest rate of baseline active caries at the 6-month, 12-month and 18-month examination

Material	6 months		12 Months		18 Months				
	NO.	%	NO.	%	NO.	%	Chi square test value		
SDF	10	28.5%	23	65.7%	31	88.5 %	Chi=7.08	**P<0.05**	df=2
Placebo	3	12%	5	20%	7	28%	Chi=1.33	**P>0.05**	df=2