JKAU: Med. Sci., **Vol. 20** No. 2, pp: 79-101 (2013 A.D. / 1434 A.H.)
DOI: 10.4197/Med. 20-2.7

One Year Follow up Study for Ozone and Fissure Sealant on Non-Cavitated Carious Lesions

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Abstract. The aim of this study was to compare the effectiveness of ozone gas and fissure sealant in managing non-cavitated occlusal fissure carious lesions in first permanent molars. Fifty patients were selected from the Pediatric Dental Clinic, Faculty of Dentistry, King Abdulaziz University. Patients were divided into 2 groups; ozone group which included 50 teeth received ozone using the HealOzone device and sealant group which included 50 teeth received pits and fissure sealant. Patients were recalled for follow up after 3rd, 6th, 9th and 12th months for assessment of caries status and sealant retention. Non-cavitated stages; at 3 months and was found in ozone group, 23 cases were reversed and 26 cases were stable, and one case progressed. In sealant group; 47 cases were reversed and 2 cases were stable and one case progressed. At 12 months, in ozone group, 48 cases were reversed and 2 cases were stable and no case progressed, while in sealant group, 48 cases were reversed and 2 cases progressed. Ozone was as effective as the fissure sealant in managing active non-cavitated occlusal fissure carious lesions in first permanent molars.

Keywords: Ozone gas, Fissure sealant, Caries, First permanent molars.

Introduction

Dental caries is the most common cause of toothache and if left untreated can lead to tooth loss[1]. Caries is an infectious oral disease that can be arrested in its early stages, and can be prevented and managed in many

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Accepted for publication: 29 December 2012. Received: 13 October 2012.

ways[2]. Approaches include primary prevention, defined as interventions provided to avert the onset of caries, and secondary prevention, defined as interventions to avert the progression of early caries to cavitation[3]. Caries progression occurs when the equilibrium between demineralization and remineralization is imbalanced, leading to a net mineral loss. If demineralization exceeds, saliva and other remineralization factors such as from calcium and fluoridated toothpastes, these tissues progressively break down, producing dental caries (cavitation)[4].

Diagnostic devices have been developed with claims of detecting the earliest signs of enamel demineralization. Therefore, affording the opportunity to intervene at an incipient stage, arrest the lesion, encourage reminerlization and avoid the need for restorative intervention. The DIAGNOdent is a laser fluorescence device that has demonstrated promising results for the detection of non cavitated occlusal caries. It operates by illuminating a tooth surface with pulses of red laser light and then analyzes the emitted fluorescence. Changes in the mineral content and porosity of tooth surface result in changes in patterns of fluorescence. A numerical value is assigned to the degree of fluorescence, which is used to indicate the extent of caries[5]. Lussi *et al.*[6] concluded that DIAGNOdent is a valuable adjunct to clinical examination and it is a reproducible method for caries detection, with good sensitivity and specificity. The good reproducibility should allow for longitudinal monitoring of the caries process and assessment of the outcome of preventive measures.

Many preventive strategies have been used to manage the non cavitated fissure carious lesions[7]. Health education, oral hygiene, plaque control, dietary counseling, fluorides, and fissure sealing are non-invasive measures that are capable of interrupting disease cycle and restoring patient oral health[8]. Pit and fissure sealants have been introduced for decades as a preventive method for controlling occlusal caries[9]. A conclusion of the National Institutes of Health (NIH) consensus panel in 1983 was that evidence supported the use of sealants to arrest the progress of non cavitated lesions[10]. Neither lesion depth nor microbiologic counts progress under sealant but this is assured only if the sealant is completely retained on teeth by using an intermediate layer of dentin bonding agent between etched enamel and the sealant[11,12].

Within the past few years, ozone therapy has been introduced as a new method for treating caries[13]. The HealOzone™ device became available as a therapeutic modality for the treatment of dental caries by the delivery of ozone to carious tooth surfaces[14,15].

The mechanism of HealOzone's action is related to its ability to oxidize proteins associated with the dental caries process. Ozone's oxidative reactions render it a powerful antimicrobial agent that destroys bacteria cell membranes and blocking enzymatic pathways[16]. Furthermore, it oxidizes the biomolecules that allow the bacterial niche to survive and expand[17]. This has a severely disruptive effect on the bacterial population in the carious lesion, therefore, swinging the equilibrium in favor of reminerlization. Thus, no more acid can be produced within the lesion when the acid-producing bacteria are eliminated[15].

A number of published studies have reported the efficacy of ozone on pit and fissure caries[18-20]. Holmes[18] found that ozone is capable of clinically reversing non-cavitated fissure carious lesions and can be considered a revolutionary alternative to conventional "drilling and filling" therapy for caries treatment. Also, Morrison and Lynch[19] and Huth *et al.*[20] reported satisfactory results of clinical trials involving the efficacy of ozone on pit and fissure caries. On the other hand, Rickard *et al.*[21] concluded that existing trials do not provide sufficient evidence that the application of ozone arrests or reverses the decay process due to short follow-up periods, and the lack of randomization or controls. In addition, Baysan and Beighton[22] concluded that ozone treatment of non-cavitated occlusal lesions for 40 seconds failed to significantly reduce the numbers of viable bacteria in infected dentine beneath the demineralized enamel.

Further research is needed to evaluate the effectiveness of pit and fissure sealant versus a new preventive agent which is ozone gas in managing non-cavitated carious lesions in first permanent molars.

Purpose

The aim of this study was to compare the effectiveness of ozone gas and fissure sealant in managing non-cavitated occlusal fissure carious lesions in first permanent molars.

Materials and Methods

Sample

i. Sample Size

The total needed sample size was 100 first permanent molars (62 mandibular first permanent molars and 38 maxillary first permanent molars equally distributed in the 2 groups).

ii. Inclusion Criteria

Selection criteria for inclusion in the study were:

- Child should be 6-8 years old to ensure that the first permanent molar is newly erupted.
- Fully erupted first permanent molar with an active non cavitated occlusal fissure carious lesion (score 1 (Opacity (white) hardly visible on the wet surface, but distinctly visible after air drying (> 5 seconds)) or score 2 (Opacity (white) distinctly visible without air drying)[23,24].
- When there was more than two first permanent molars with an active non-cavitated occlusal fissure carious lesion, the one that had a higher CSI score (CSI score 2) was selected.
- The selected tooth should be free of cavitation on any other surface.
- The child should have a previous caries experience in the primary dentition.
- Free of any medical conditions that may impede proper oral hygiene procedures.
- Absence of prolonged antibiotic therapy.

iii. Recruitment

Fifty patients (30 females and 20 males) were selected from the Pediatric Dental Clinic, Faculty of Dentistry, King Abdulaziz University. Each patient had at least 2 first permanent molars with active non-cavitated carious lesions. Each patient had one molar treated by ozone and another molar by fissure sealant. To recruit participants for the study, the two investigators who were faculty staff members (Kappa: 0.98) attended the examination in the clinic for selection of patient fitting the inclusion criteria.

Equipments and Materials

The following equipments were used:

HealOzone Device

HealOzone device (Curozone Inc., USA and KaVo, Germany) is a portable apparatus that delivers at a concentration of 2,100 ppm ± 10% ozone. The vacuum pump sucks air through the generator at a rate of 615 cc/minute to supply ozone to the lesion[18]. The same vacuum pump is used to purge the system of ozone after the treatment. It includes a source of oxidizing gas and a dental hand piece with a cup for delivering the gas to the lesion. A removable silicon cup, which is attached to the hand piece, is provided for receiving the gas and exposing a selected area of the tooth to the gas. Differently shaped silicon cups are available that corresponds to form of various teeth and their surfaces[13]. The tightly fitting cup includes a resilient edge for sealing the edge of the cup against the selected area on the tooth to prevent escape of ozone.

DIAGNOdent:

DIAGNOdent (KaVo, Biberach, Germany) is a compact and portable device which consists of a control unit and a hand-held probe. The probe comes with 2 attachments, one with a small tip, for examining fissure caries, and the other with a larger, broader tip, for examining smooth surfaces[5].

The following materials were used:

Pits and fissure sealant (UltraSeal XT® Plus – Ultradent Products, Inc., Utah, USA).

Study Design

The design was a randomized controlled clinical trial with two parallel groups. These two groups were designed to test the effectiveness of two approaches for the management of non-cavitated carious lesions.

Group I: Test group (ozone group): Included 50 teeth received ozone using the HealOzone device[20].

Group II: Control group (sealant group): Included 50 teeth received pits and fissure sealant.

Methods:

A- At Base Line:

1. Patients who fulfill the inclusion criteria were assessed as regards:
   - Previous caries experience using dmfs index for primary teeth and DMFS index for permanent teeth.

2. The selected molar received prophylaxis using a non-fluoridated polishing paste and a rubber cup and was further assessed as regards:
   - Clinical Severity Index (CSI)[23,24].
   - DIAGNOdent reading using DIAGOdent Laser Device[25].

3. Following these procedures, patients were randomly assigned to one of the 2 study groups:

a. ***Ozone group:*** the selected molar received ozone for 40 seconds using the HealOzone device after assuring a dry field by isolating the molar with a rubber dam[20].

b. Sealant group: the selected molar was completely isolated using the rubber dam and saliva ejector then etched using 35% phosphoric acid for 15-20 seconds followed by rinsing then air drying until the characteristic "frosted enamel" appearance is evident. PrimaDry was applied for 5 seconds followed by gentle air drying. The sealant was applied and photocured for 20 seconds. Occlusion was adjusted using an articulating paper. The sealant was checked for complete coverage of all pits and fissures, retention and complete polymerization by the aid of a fine probe and mirror.

B- Follow up

1. Patients were recalled for follow up after 3^{rd}, 6^{th}, 9^{th} and 12^{th} months for outcome assessment.
2. Sealant was reapplied if it was partially or totally lost. Ozone was reapplied if caries was progressing as indicated by receiving score 2 in two consecutive visits.
3. Lesions progressing to cavitation (CSI score $\geq$ 3) were restored using preventive resin restoration.

Outcome Assessment

Clinical Assessment

1. DIAGNOdent assessment:

- In all groups, DIAGNOdent reading was measured for the selected molars[25]. A change from lower scores to higher scores was considered indicative of caries progression and vice versa.
- In the sealant group, DIAGNOdent was applied over the sealant from region of mesial, distal, buccal, lingual and central fissures.

2. Visual assessment:

- In all groups, CSI[23,24] was used to detect caries reversal, progression or arrest.
- In the sealant group, caries was assessed around the sealant or in the exposed tooth surface if the sealant was partially lost using the CSI. The Color Coverage Caries (CCC) Sealant Evaluation System was used to assess sealant retention[26]. (Code A: Sealant present on all of fissure system, Code B: Sealant present on > 50% of fissure pattern but some missing, Code C: Sealant present on < 50% of fissure pattern, Code D: No sealant present).

Protection of Human Subjects[27]:

1. An informed consent for participation was obtained from parents.
2. This study was conducted in compliance with all policies of appropriate patient care at King Abdulaziz University. The Ethical Committee of Preventive Dental Sciences Department at King Abdulaziz University approved the research protocol.
3. Patients participating in the study received the benefit of regular dental checkups as well as treatment of other oral problems they might had.

Statistical Analysis

All the data were collected, tabulated, and statistically analyzed using Statistical Package for Social Sciences (SPSS) version 19. "Student's" *t*-test, Pearson's chi-squared (χ^2) test and Freidman test were used to compare the observed data.

Results

The present study consisted of 50 patients, 6-8 years old. All 100 first permanent molars were available for examination at each of the 3, 6, 9 and 12 month evaluations. Those patients were examined by the same investigators and the result was found to be 0.98 according to Cohen's kappa coefficient.

Baseline Sample Characteristics

Table 1 shows comparison among the two study groups as regards caries experience in primary (dmfs) and permanent teeth (DMFS). There was no statistically significant difference observed among the two study groups as regards caries experience in the primary or permanent teeth (p = 0.094 and 0.527, respectively).

Table 2 shows comparison among study groups as regards CSI score at baseline. Percentages of score 1 were 76 in *Ozone* group and 80 in *Sealant* group while percentages of score 2 were 24 in *Ozone* group and 20 in *Sealant* group. There was no statistically significant difference among study groups (p = 0.629).

Table 3 shows comparison among the two study groups as regards DIAGNOdent reading values at baseline. There was statistically significant difference among the two study groups (mean values were 45.08 ± 13 and 36.07 ± 12 for *Ozone* and *Sealant* groups, respectively) (p = 0.0003).

Table 1. Comparison among study groups as regards caries experience in primary (dmfs) and permanent teeth (DMFS).

Study groups / **Caries experience**		***Ozone***	***Sealant***	**Test* (p Value)**
dmfs	Mean	13.85	17.24	1.68
	± SD	± 8.7	± 11.34	(0.094)
DMFS	Mean	1.12	1.08	0.63
	± SD	± 0.4	± 0.2	(0.527)

**Test: t-test for both dmfs and DMFS*

Table 2. Comparison among study groups as regards Clinical Severity Index scores at baseline.

Study Groups	***Ozone***	***Sealant***
CSI score	n (%)	n (%)
Score 1	38(76)	40(80)
Score 2	12(24)	10(20)
Total	50(100)	50(100)
χ^{2*}	0.23	
(P value)	(0.629)	

** χ^2: Chi square test*

Table 3. Comparison among study groups as regards DIAGNOdent reading values at baseline.

Study Groups	*Ozone*	*Sealant*
DIAGNOdent values		
Mean ± SD	45.08 ± 13	36.07 ± 12
t-test	3.60	
(p value)*	(0.0003)	

*: *Statistically significant ($p \leq 0.001$)*

Follow up

Table 4 and Fig. 1 show comparison of transitions between non-cavitated stages among study groups at 3 months follow-up examination. In *Ozone* group, 46% of the cases were reversed while 52% were stable. In *Sealant* group, 94% were reversed while 4% were stable. There was a statistically significant difference among study groups as regards number of cases showing reversal, stability and progression (p = 0.000).

Table 4. Comparison of transitions between non-cavitated stages among study groups at 3 months follow-up examination.

Study Groups Transitions	*Ozone* n (%)	*Sealant* n (%)
Reversed	23 (46)	47 (94)
Stable	26 (52)	2 (4)
Progressed	1 (2)	1 (2)
Total	50 (100)	50 (100)
χ^{2*}	28.80	
(p value)†	(0.000)	

*χ^2: *Chi square test*
†: *Statistically significant ($p \leq 0.001$)*

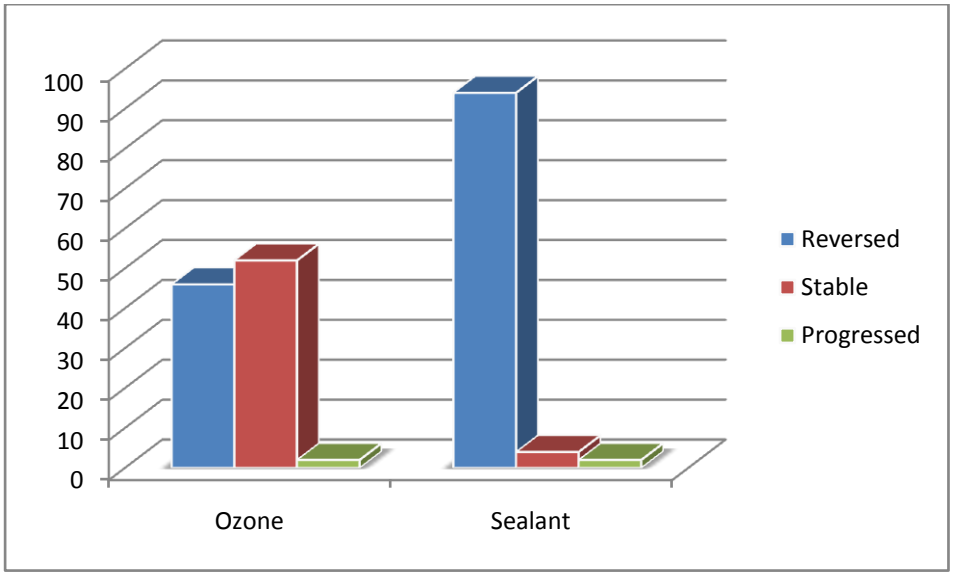

Fig. 1. Comparison of transitions between non-cavitated stages among study groups at 3 months follow-up examination.

Table 5 and Fig. 2 show comparison of transitions between non-cavitated stages among the two study groups at 6 months follow-up examination. Reversal was the most common transition in both study groups (94% and 96%, respectively). There was no statistically significant difference among the two study groups as regards number of cases showing reversal, stability and progression (p = 0.310).

Table 5. Comparison of transitions between non-cavitated stages among study groups at 6 months follow-up examination.

Study Groups **Transitions**	***Ozone*** **n (%)**	***Sealant*** **n (%)**
Reversed	47 (94)	48 (96)
Stable	2 (4)	0
Progressed	1 (2)	2 (4)
Total	50 (100)	50 (100)
χ^{2*}	2.34	
(p value)	(0.310)	

*χ^2: *Chi square test*

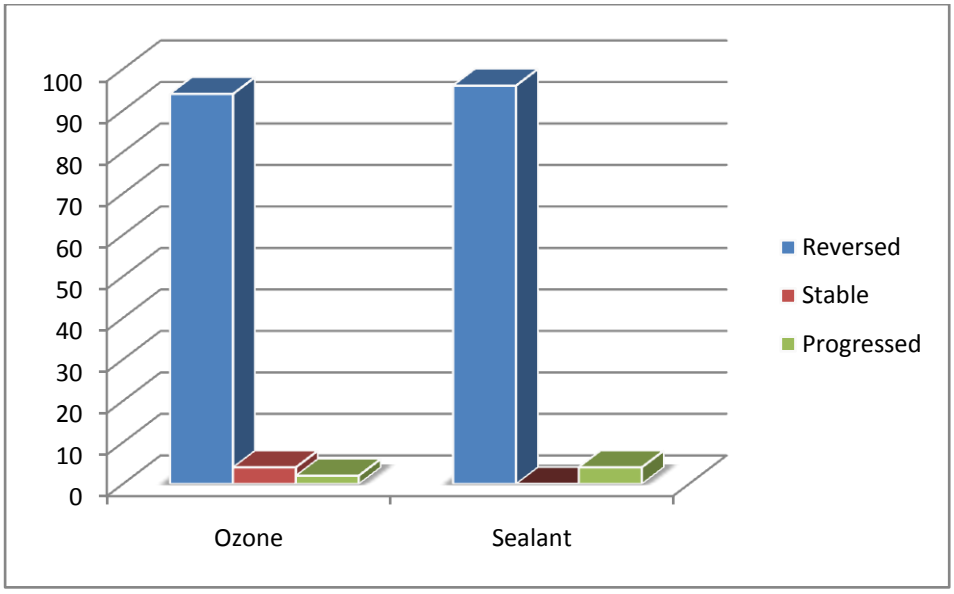

Fig. 2. Comparison of transitions between non-cavitated stages among study groups at 6 months follow-up examination.

Table 6 and Fig. 3 show comparison of transitions between non-cavitated stages among study groups at 9 months follow-up examination. The majority of cases in *Ozone* group showed reversal (90%) while in *Sealant* group, all cases showed reversal. There was no statistically significant difference among study groups as regards the number of cases showing reversal, stability and progression (p = 0.072).

Table 6. Comparison of transitions between non-cavitated stages among study groups at 9 months follow-up examination.

Study Groups **Transitions**	***Ozone*** **n (%)**	***Sealant*** **n (%)**
Reversed	45 (90)	50 (100)
Stable	4 (8)	0
Progressed	1 (2)	0
Total	50 (100)	50 (100)
X^{2*}	5.26	
(p value)	(0.072)	

*X^2: *Chi square test*

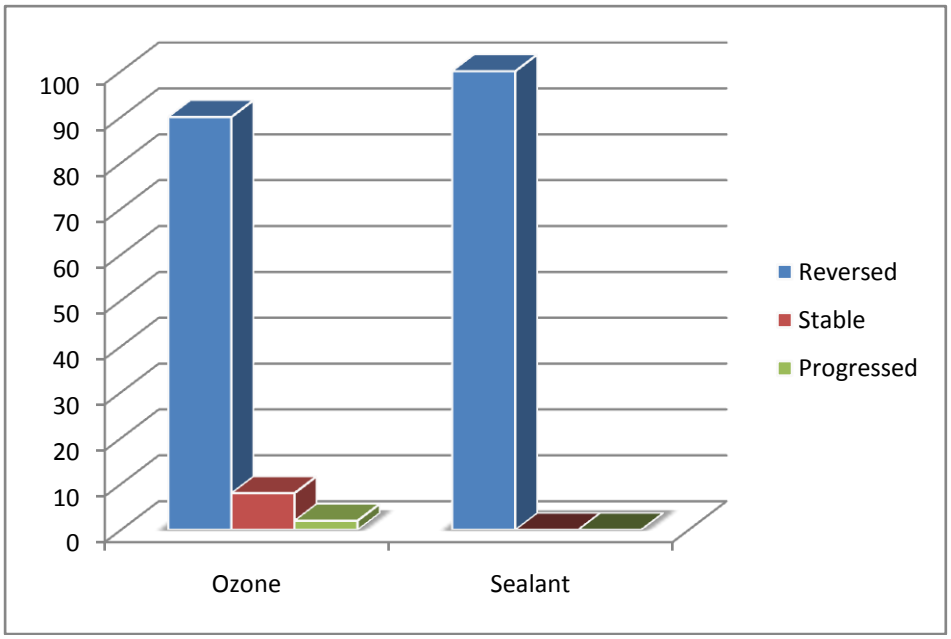

Fig. 3. Comparison of transitions between non-cavitated stages among study groups at 9 months follow-up examination.

Table 7 and Fig. 4 show comparison of transitions between non-cavitated stages among the two study groups at 12 months follow-up examination. In *Ozone* group, 96% of the cases were reversed and 4% were stable and no case progressed, while in *Sealant* group, 96% of cases were reversed and 4% progressed. There was no statistically significant difference among the two study groups as regards the number of cases showing reversal, stability and progression (p = 0.135).

Table 7. Comparison of transitions between non-cavitated stages among study groups at 12 months follow-up examination.

Study Groups **Transitions**	***Ozone*** **n (%)**	***Sealant*** **n (%)**
Reversed	48 (96)	48 (96)
Stable	2 (4)	0
Progressed	0	2 (4)
Total	50 (100)	50 (100)
X^{2*}	4.0	
(p value)	(0.135)	

*X^2: *Chi square test*

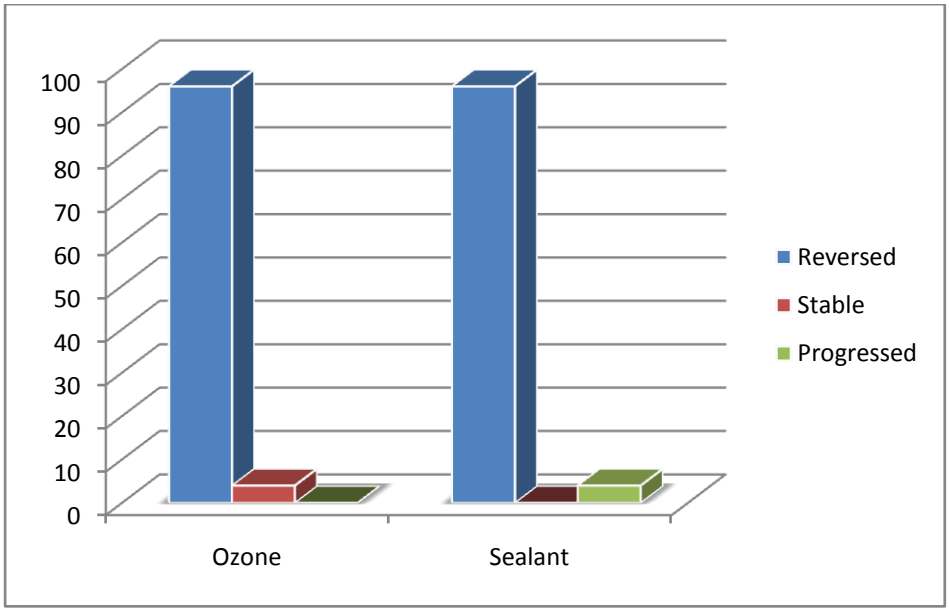

Fig. 4. Comparison of transitions between non-cavitated stages among study groups at 12 months follow-up examination.

Table 8 and Fig. 5 show comparison of codes of coverage component in CCC Sealant Evaluation System in *Sealant* group among follow-up examinations. It was observed that code A had the highest percentage (96%, 86%, 84% and 74% at 3, 6, 9, and 12 months follow-up examinations, respectively). None of the cases had code D among follow-up examinations. There was no statistically significant difference in CCC codes in *Sealant* group among follow-up examinations ($p = 0.975$).

In both study groups, DIAGNOdent reading values decrease as time passes from baseline to 12 months follow-up examinations. The DIAGNOdent reading values were between 20 and 60 at 3 months follow-up examination. At 6 months follow-up examination, the reading values were between 15 and 55. At 9 months follow-up examination, the reading values were between 15 and 45. At 12 months follow-up examination, the reading values were between 10 and 40.

Table 8. Comparison of codes of coverage component in Color Coverage Caries (CCC) sealant evaluation system in *Sealant* group among follow-up examinations.

Follow-up Examinations / Codes	3 months n (%)	6 months n (%)	9 months n (%)	12 months n (%)
A*	48 (96)	43 (86)	42 (84)	37 (74)
B†	1 (2)	5 (10)	6 (12)	11 (22)
C‡	1 (2)	2 (4)	2 (4)	2 (4)
D§	0	0	0	0
Total	50 (100)	50 (100)	50 (100)	50 (100)
Freidman test	0.692			
(p value)	(0.975)			

* *Sealant present on all of fissure system*
† *Sealant present on > 50% of fissure pattern but some missing*
‡ *Sealant present on < 50% of fissure pattern*
§ *No sealant present*

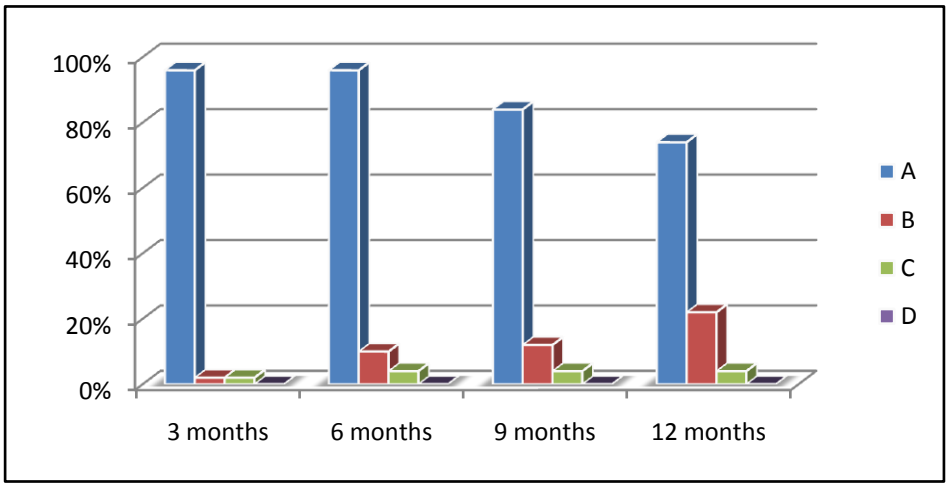

Fig. 5. Comparison of codes of coverage component in Color Coverage Caries (CCC) Sealant Evaluation System in *Sealant* group among follow-up examinations.

Discussion

The present study was conducted to compare the effectiveness of ozone gas and fissure sealant in managing non-cavitated occlusal fissure carious lesions in first permanent molars.

Non-cavitated fissure carious lesions represent the earliest phase of tooth decay or demineralization and are capable of being reversed, arrested, or progressing to cavitation[28]. Many preventive strategies have been used to manage non-cavitated fissure carious lesions[8]. Evidence

supports the use of sealants to arrest the progress of these lesions as active lesions become inactive beneath intact sealants; however, sealant's efficacy is only assured if they are completely retained on teeth[3,29]. The present study was stimulated by the published evidence that ozone's oxidative reactions can destroy bacteria by oxidizing bacterial cell membranes and blocking enzymatic pathways[30]. This has a disruptive effect on the bacterial population in the carious lesion which results in swinging the equilibrium in favor of remineralization.

Selection of the approaches used in this study was according to Baders and Shugars[31]. They reported that options of management of non-cavitated lesions included sealing the occlusal surface and attempting to halt progression, and remineralize the lesion according to which *Sealant* and *Ozone* approaches respectively were used in the present study.

Regarding the results of the present study, it was observed that DIAGNOdent had high reading values at baseline, although non-cavitated caries should have DIAGNOdent reading values between 10 and 20. This agreed with Johnson *et al.*[32] who observed that non-cavitated occlusal fissure carious lesions exhibited DIAGNOdent reading values between 20 and 60 at baseline. This was explained by Hosaya *et al.*[33] who found that because DIAGNOdent reacted to any material that emitted light (fluorescent material), polishing paste particles that might remain in deep and narrow fissures after polishing could influence DIAGNOdent reading values.

Not only DIAGNOdent had high reading values at baseline but also, it was found that its reading values were high through all the follow-up examinations. This may be due to the possibility that chromophore rings become imbedded into the tooth's structure and causing wrong (too high) values during the remineralization process as was stated by KaVo Company. Chromophore rings, which are rings of chemical residues that produce color in a compound of which it is an ingredient, would result in changing in patterns of fluorescence and raising DIAGNOdent reading values[34]. This agreed with Holmes[35] who postulated that the remineralization process led to an increase in the stain or coloration of the lesions and resulted in raising DIAGNOdent values. Similar findings were reported by Ricketts[36] who reported that DIAGNOdent tended to over-score discolored sites, therefore it should not be relied on as a clinician's primary diagnostic method.

It was found that fissure sealants had low caries progression percentages through all follow-up examinations (2, 4, 0 and 4% at 3, 6, 9 and 12 month's follow-up examination, respectively). This agreed with the National Institutes of Health Consensus Development Conference that concluded that carious lesions covered by sealants become inactive and the process of tooth decay was apparently arrested by the sealant[10]. Similar findings were reported by Florio *et al.*[37] who found that sealants were able to arrest the progression of caries after they were applied on active non-cavitated lesions.

Sealant was reapplied in follow-up examinations if it was partially or totally lost due to the efficacy of pit and fissure sealants This was only assured if they were completely retained on teeth as was stated by Weintraub[29], which resulted in increasing the reversal percentages of caries in *Sealant* group. This agreed with Komatsue *et al.*[38] who reported that reapplication seemed to improve caries reduction. Similarly, Reeves *et al.*[39] found that the preventive effect was higher when sealants were reapplied, compared to a single application in which sealant effectiveness decreased over time if sealant was partially or totally lost.

For transitions between non-cavitated stages in *Ozone* group, it was found that 96% of cases were reversed while the other 4% remained stable and none progressed to worse after 12 months. *Ozone* group had high reversal percentages (46, 94, 90 and 96% at 3, 6, 9 and 12 months follow-up examination, respectively). Similar findings were reported by Abu Naba'a[40] who found that ozone group had better CSI scores than the negative control group. Morrison and Lynch[19] also found that 87% of cases treated with ozone reversed, the other 13% remained stable and none became worse while Holmes[35] found that over 93% of the ozone treated occlusal fissure carious lesions had clinically reversed.

This also agreed with Johnson *et al.*[32] who demonstrated that ozone was able to clinically reverse occlusal pit and fissure carious lesions after 6 and 12 months, even with a limited exposure time of 10 seconds. This was assured using DIAGNOdent reading scale in adjunct to the visual examination using the CSI. This finding was explained by Bunning and Hempel[41] who stated that oxidation due to ozone induced the destruction of cell walls and cytoplasmic membranes of microorganisms after which the permeability of the membrane increased. In addition, ozone molecules could readily enter the cells disrupting the bacterial enzymatic

pathways and bacterial population in the carious lesion which resulted in swinging the equilibrium in favor of remineralization.

This was further clarified by Kamali *et al.*[42] who found that using ozone resulted in reduction of the number of Streptococcus Mutans bacteria. Holmes[43] stated that the ability of ozone to remove proteins in carious lesions, and to enable calcium and phosphate ions to diffuse through the lesions, a phenomenon resulting in remineralization of the majority of the non-cavitated carious lesions after ozone application. He also concluded that reduction of bacterial by-products and metabolites by ozone had two effects. First, the by-products could not cause further demineralization of the lesion. Second, the removal of important bacterial metabolites deprived other bacterial types in the lesion from their important nutrients which resulted in long-term suppression of acidogenic and aciduric microorganisms. In this way, ozone had a dual effect when used to control non-cavitated carious lesions.

High caries reversal percentages were found in *Ozone* and *Sealant* groups although ozone and sealant were used alone without using any other remineralizing agent. This was explained by Silwood *et al.*[44] who found that patient's saliva contained all bio-available mineral components required for the remineralization process, ozone and sealant treatment alone, without the adjunct toothpastes and mouth rinses could be all that was required for reversal of carious lesions.

However, according to Brazzeli *et al.*[45] unless patients improved their oral hygiene for plaque control and eliminated the causes of increased numbers of microorganisms, the plaque would re-form and the lesion would progress again. That what might happen in the three cases which progressed to cavitation in *Ozone* group through the whole study period.

As regards comparison of codes of coverage component of the CCC Sealant Evaluation System in *Sealant* group among follow-up examinations, it was found that percentages of cases that had code A were 96%, 86%, 84% and 74% at 3, 6, 9, and 12 months follow-up examinations, respectively. This finding was similar to that of Galal[46], who used the same type of sealant (UltraSeal) and observed that code A had the highest percentage. There was no statistically significant difference in codes of coverage component of the CCC Sealant Evaluation System among follow-up examinations. This also agreed

with Galal[46], who found that there was no statistical difference in sealant coverage codes among follow-up examinations.

This present study design had the following limitations:

1. Small sample size.
2. Difficulty in selecting first permanent molars that fits the inclusion criteria.
3. Short follow-up.

More well designed and conducted double-blind randomized clinical trials with adequate sample size, limited or no loss to follow up, and carefully standardized methods of measurement and analysis are needed to evaluate the possible use of ozone as a treatment modality in dentistry[47].

Conclusions

Ozone was as effective as the fissure sealant in managing active non-cavitated occlusal fissure carious lesions in first permanent molars in which the majority of carious lesions treated with ozone were reversed, the minority remained stable and none progressed to a worse non-cavitated stage at12 months.

There was no statistically significant difference among *Ozone* and *Sealant* groups as regards the number of cases showing reversal, stability and progression at 12 months follow-up examination.

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عام واحد متابعة لدراسة الأوزون و ختام الشق في التدبير العلاجى على الآفات التسويسية النشطة غير الجوفاء

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الإسكندرية – مصر

المستخلص. هدف هذه الدراسة هو مقارنة فاعلية غاز الأوزون و ختام الشق في التدبير العلاجى للآفات التسويسية النشطة غير الجوفاء فى الشق الطاحن في الضروس الدائمة الأولىتم اختيار خمسين مريض من عيادة طب أسنان الأطفال، كلية طب الأسنان، جامعة الملك عبد العزيز. تم تقسيم المرضى لمجموعتين: مجموعة الأوزون و اشتملت على ٥٠ حالة أسنان تم معالجتها باستخدام الأوزون عن طريق جهاز هيل اوزون ومجموعة الختام واشتملت على ٥٠ حالة أسنان تم معالجتها باستخدام ختام الشق والوهدة. تم استدعاء المرضى مرة أخرى للمتابعة بعد، و٦، و ٩، و ١٢ شهراً لتقييم حالة التسوس و عملية ثبات الختام. تبعاً للمراحل غير الجوفاء، عند٣ أشهر، وجد أنه في مجموعة الأوزون حدث اعتكاس لـ٢٣ حالة بينما كانت٢٦ حالة مستقرة،وحدث تطور لحالة واحدة. أما في مجموعة الختام حدث اعتكاس لـ٤٧ حالة وكان هناك حالتان مستقرتان وتطورت حالة واحدة. في فترة١٢ شهر، في مجموعة الأوزون، اعتكست ٤٨ حالة واستقرت حالتان ولم تتطور أي حالة بينما في مجموعة الختام، اعتكست ٤٨ حالة وتطورت حالتان. كان الأوزون فعال مثل ختام الشق

في التدبير العلاجى فى علاج الأفات التسويسية النشطة الغير جوفاء فى الشق الطاحن في الضروس الدائمة الأولى.