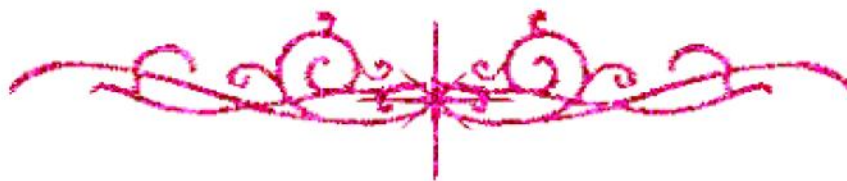


# بِسْمِ اللّٰهِ الرَّحْمٰنِ الرَّحِیْمِ





# شبكة المعلومات الجامعية التوثيق الالكتروني والميكروفيلم



# جامعة عين شمس

التوثيق الإلكتروني والميكروفيلم

## قسم

نقسم بالله العظيم أن المادة التي تم توثيقها وتسجيلها  
علي هذه الأقراص المدمجة قد أعدت دون أية تغيرات



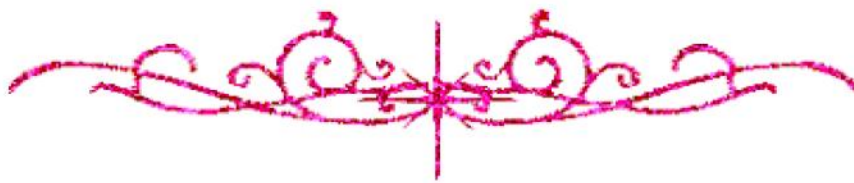
## يجب أن

تحفظ هذه الأقراص المدمجة بعيدا عن الغبار



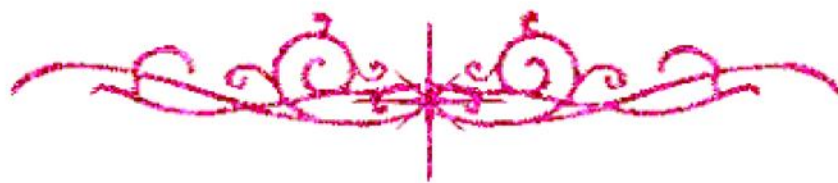


# بعض الوثائق الأصلية تالفة





# بالرسالة صفحات لم ترد بالأصل



**"Comparing The Effect of Chicken Eggshell Powder Solution, 5% Sodium Fluoride Varnish And 5% Sodium Fluoride containing Tricalcium Phosphate Varnish On Early Enamel Carious Lesion In Permanent Teeth: An In Vitro Study"**

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## **List of Abbreviations**

**ACP:** amorphous calcium phosphate.

**BMD:** bone mineral density.

**CEJ:** cement-enamel junction.

**CESP:** Chicken Egg Shell Powder Solution.

**CPP:** casein phosphopeptide.

**CPP-ACP:** casein phosphopeptide amorphous calcium phosphate.

**CTC:** clinpro tooth crème.

**DDW:** deionized water.

**EDI:** Enamel Decalcification Index.

**F:** fluoride.

**FA:** fluoro hydroxyapatite.

**fTCP:** Functionalized Tricalcium Phosphate.

**HA:** hydroxyapatite .

**IEC:** initial enamel caries.

**MH:** microhardness.

**MID:** minimal invasive dentistry.

**MIH:** molar incisor hypomineralization.

**NAH:** nano-hydroxyapatite.

**OHRQOL:** oral health related quality of life.

**RBCs:** red blood cells.

**SDF:** silver diamine fluoride.

**SEM-EDX:** scanning electron microscope energy dispersive x-ray.

**STMP:** sodium trimetaphosphate.

## *Introduction*

**TCP:** Tricalcium Phosphate.

**TMP:** tooth mousse plus.

**WHO:** world health organization.

## **Introduction**

Dental caries is a dynamic process in which demineralization exceeds re-mineralization, however progression of dental caries is a slow process <sup>[1]</sup>. The first clinical sign of enamel caries is a white spot lesion, which precedes cavitation. Therefore, the early diagnosis and treatment of white spot lesions is extremely important. White spot lesions are considered reversible if they are detected early <sup>[2]</sup>. The reversal can occur if pH in the oral cavity rises resulting in deposition of calcium, phosphate and fluoride <sup>[1]</sup>.

Surgical approach has long been used for the elimination of carious lesion, this approach was the only approach used, because there was no valid alternative <sup>[3]</sup>.

The focus on caries management has shifted from the surgical removal to the development of methodologies for the use of non-invasive treatment for these lesions. The non-invasive treatment of early carious lesions by re-mineralization is one of the non-invasive methods of caries management. Re-mineralization of white-spot lesions may be possible with a variety of currently available agents containing fluoride, bioavailable calcium and phosphate, and casein phosphopeptide in-amorphous calcium phosphate <sup>[3]</sup>.

Chicken eggshell is a natural bioceramic composite that has a unique chemical make-up of inorganic and organic compounds. It consists of an inorganic shell and an organic membrane. The inorganic constituent of eggshells is mainly calcium carbonates, whereas its organic compounds are

## *Introduction*

proteins, glycoprotein, and proteoglycan. Owing to this unique chemical composition, eggshell has extensively gained attention among researchers for its medical and dental benefits <sup>[4]</sup>. The presence of high calcium content in eggshells is expected to enhance the remineralization process of early enamel carious lesions; however its efficacy and form of application has yet to be tested against popular remineralizing agents <sup>[5]</sup>.

## **Review of literature**

Dental caries is a dynamic disease, non-cavitated caries lesions are considered the initial stages of more severe and frankly cavitated caries lesions [6].

Initial enamel caries (IEC) is first observed clinically as a "white spot lesion" which is a small area of sub-surface demineralization. The body of the sub-surface lesion may have lost as much as 50% of its original mineral and often has an apparently intact surface layer over it [7].

It still represents one of the most prevalent diseases, affecting nearly most of the general population in most countries and is considered a major concern in the dental community [8]. In the primary dentition, caries is the 10th most prevalent oral problem [9]. Also it affects 60–90% of school-aged children and the vast majority of adults [10].

Untreated carious cavities have significant impact on the general health of children and on the social and economic wellbeing of communities [11].

It also affect growth and development and is associated with a negative impact on oral health-related quality of life (OHRQOL), Children with untreated dental caries have a poor OHRQOL, expressed in the form of the occurrence of toothache, problems eating certain foods, sleeping difficulty and changes in behavior, and the problem tend to worse with the progression of the dental caries [9].

## Review of literature

Demineralization occurs by the action of lactic acid produced by bacterial carbohydrate metabolism on tooth; this action leads to release of mineral ions into the biofilm (plaque) [3].

The pH for which the fluid becomes saturated with minerals is so-called 'critical pH' at which equilibrium exists (no mineral dissolution and no mineral precipitation), for hydroxyapatite (HA), the critical pH is around 5.5, while it is approximately 4.5 for fluoro hydroxyapatite (FA). [12]

The pH fall has a profound effect on the solubility of hydroxyapatite and other calcium phosphates, in general the solubility of apatite increases 10 times with a decrease of 1 pH unit. This happens because  $H^+$  combines with  $PO_4^{-3}$  and  $OH^-$  to form  $H_2PO_4^{-3}$  and  $H_2O$ , as a consequence, the concentrations of free  $PO_4^{-3}$  and  $OH^-$  are reduced, turning the solution under-saturated with respect to enamel, promoting enamel dissolution, this dissolution can be avoided by increasing the concentrations of  $Ca^{+2}$  and / or  $PO_4^{-3}$  in the biofilm. When the pH is above the critical level for the formation of a respective mineral phase, precipitation of this phase occurs (remineralization), contrarily when the pH is below the critical level; dissolution takes place (demineralization) [12].

The term "remineralization" is used to describe mineral gain. Remineralization is the body's natural repair process for subsurface non-cavitated carious lesions. In the process of remineralization, calcium and phosphate ions are supplied from a source external to the

## *Review of literature*

tooth to promote ion deposition into crystal voids in demineralized enamel to produce net mineral gain <sup>[13]</sup>.

Remineralization relies on calcium and phosphate ions assisted by fluoride to rebuild a new surface on existing crystal remnants in subsurface lesions remaining after demineralization. These remineralized crystals are less acid soluble than the original mineral composition and the concentration of inorganic ions in saliva and in dental plaque significantly influence the degree of saturation of the water-rich fluid which is in immediate contact with enamel <sup>[14]</sup>.

The oral fluid mainly comprising saliva and gingival crevicular fluids are rich in calcium, phosphate and fluoride ions. This results in a dynamic equilibrium between the mineral content of tooth and oral fluid in a neutral pH. In conditions when the pH is neutral, there is the minimal dissolution of hydroxyapatite crystals releasing calcium ( $\text{Ca}^{2+}$ ), phosphate ( $\text{PO}_4^{3-}$ ) and hydroxyl ( $\text{OH}^-$ ) ions that are already present in the oral fluid. An Increase in  $\text{Ca}^{2+}$ , and  $\text{PO}_4^{3-}$  ions in the oral fluid leads to supersaturation of the solution and precipitation of the minerals back onto the tooth surface that can be termed as remineralization <sup>[15]</sup>.

The process of remineralization is a dynamic caries process; there are intermittent periods of demineralization and remineralization, the periods during which there is a return to the resting plaque pH is when remineralization occurs. The repair or healing of the lesion occurs by deposition of mineral on existing damaged crystals (crystal