Evaluation of Extrinsic Stain and Microhardness of Primary Teeth Enamel after Exposure to Different Pediatric Iron Supplements: An In Vitro Study

Thesis Submitted to

the Faculty of Dentistry, Ain Shams University

In Partial Fulfillment of the Requirements for the Master Degree in Pediatric Dentistry

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B.D.S (2009)

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2017

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ACKNOLEDGMENT

*First and foremost, thanks are due to **Allah** the most beneficent, for the unlimited and continuous blessing on me.*

*I would like to express my deepest appreciation and gratefulness to **Prof. Dr. Nadia Ezz El-Din Metwalli,** Professor of Pediatric Dentistry and Dental Public Health, Faculty of Dentistry, Ain Shams University, for her excellent guidance, sincere advices, valuable time and effort during the period of this study.*

*I would like to thank **Dr.Mariem Osama Wassel,** Lecturer in department of Pediatric Dentistry and Dental Public Health, Faculty of Dentistry, Ain Shams University for her patient guidance, her response to my questions and queries so promptly and advice she has provided throughout performing this thesis.*

*Deep thanks and greatest appreciation to **Prof. Dr. Amani Osman Mahmoud,** Professor of Pediatrics, Faculty of Medicine, Ain Shams University, for the facilities she*

offered me throughout this work and for her unlimited support, encouragement and cooperative spirit.

I feel thankful to my friends who never declined from offering help and assistance to me and gave me a hand when I was in most need of it.

Dedication

My mother,

I have no words *to write how she loves me, She is my number one supporter in my life, from the moment I was born and every day that follows.* ***I love you mom***

My father,

For his endless love and support and encouragement throughout my life.

My husband Ali,

I am so glad to have you as my husband, you are an important part in my life, and without you I would never be what I am today.

My brothers and sisters,

Ongoing love and support.

My Kids,

Who, lighten up my life, I wish a long happy life.

My aunts and my uncle,

Deserve my whole hearted thanks as well.

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INTRODUCTION

The appearance of the dentition is of concern to a large number of people seeking dental treatment and the color of the teeth is of particular cosmetic importance [1].

Drugs can induce superficial tooth discoloration after eruption of teeth in the oral cavity. Extrinsic staining can be removed by tooth brushing. Drugs that cause extrinsic tooth staining include mouth rinses such as chlorhexidine containing mouth rinses, iron salts, heavy metals, essential oils, amoxicillin-clavulanic acid and ciprofloxacine[2].

Dental erosion is the acid dissolution of dental hard tissues caused by multiple factors. One of these factors are acidic substances in the diet [3]. Erosion can occur in both deciduous and permanent teeth [4, 5]. It starts with a softening of the enamel tooth surface and progresses to extensive loss of tooth substance when contact with the acids continuously [6, 7].

Primary teeth enamel is histologically different from permanent teeth enamel. Prism arrangements in primary and permanent teeth enamel are similar [8], but the prisms in primary teeth enamel are smaller, with more complete boundaries and are more widely spread than those in permanent teeth enamel [9]. The prisms in primary teeth enamel are more gently curved and have slightly less pronounced Hunter-Schregerbands[9]. Primary teeth enamel is considerably less mineralized [10]. It has greater total carbonate content, and a higher organic content than permanent enamel[11]. These histological differences may lead to different erosion patterns

in primary enamel. It is important to fully investigate the effect of different dietary substances on primary teeth enamel [11].

Studies that evaluate the effects of pediatric iron supplements on primary teeth enamel are scarce. It would be of great importance to assess such effects. The aim of the present study was to evaluate extrinsic tooth staining and surface microhardness of enamel of primary teeth exposed to two commonly prescribed pediatric iron supplements in Egypt.

REVIEW of LITERATURE

Tooth discoloration is a common dental finding that is associated with esthetic problems [12]. It differs in etiology, appearance, composition, location, severity and degree of adherence[12,13].

Types of tooth discolorations:

Tooth discolorations are classified according to the location of the stain into extrinsic, intrinsic, or internalized. Extrinsic discoloration is deposited on the tooth surface or in the acquired pellicle. The compounds that are incorporated into the pellicle produce a stain due to either their basic color or chemical interaction at the tooth surface. Intrinsic stains occur when the tooth structure is penetrated by pigmented materials, usually during tooth development. Internalized discoloration is the incorporation of extrinsic stain within the tooth substance following dental development [12-17].

Etiology and types of extrinsic stain:

Extrinsic staining has a multi-factorial etiology such as tobacco (smoking and chewing), particular beverages such as tea and coffee and chromogens derived from dietary sources or habitually placed in the mouth. These organic chromogens are taken up by the pellicle and the color imparted is determined by the natural color of the chromogen. The color seen on the tooth is thought to be derived from polyphenolic compounds which provide the color in food [1].

The attraction of materials to the tooth surface is crucial to the formation of extrinsic dental stain. These attractive forces include electrostatic, Vander Waals, hydration forces, hydrophobic interactions, and hydrogen bonds. However, the mechanisms that determine the strength of adhesion are not clearly understood[12,13,18,19].

Extrinsic staining has usually been classified according to its origin, whether non-metallic or metallic. The non-metallic extrinsic stains are adsorbed onto tooth surface deposits such as plaque or the acquired pellicle. The possible etiological factors include dietary components, beverages, tobacco, mouth rinses and other medicaments [1].

The metallic extrinsic staining of teeth may be associated with occupational exposure to metallic salts or exposure to a number of medicines containing metal salts. The characteristic black staining of teeth in people using iron supplements and iron foundry workers is well documented [1].

Particular colors of extrinsic staining are said to be associated with oral hygiene condition, for instance, green and orange in children with poor oral hygiene and black/brown stains in children with good oral hygiene and low caries experience[1].

Black extrinsic stains:

A specific type of external discoloration is called black stain. It is defined as a dark line or an incomplete coalescence of dark dots formed on the cervical third of the crown and following the contour of the gingival margin, and is firmly attached to the tooth surface[20].

Black stain is a common finding in children; however it can be also seen in adults [21]. The grooves, pits, and fissures can also be found to be impregnated with such pigmentation, which is difficult to remove, particularly in these areas [22].

Black extrinsic stain is considered to be a special form of dental plaque with a tendency for calcification [21,23]. The ultra-structural examination of this deposit showed microorganisms embedded in a matrix. Almost all of bacteria were Gram-positive rods[24]. The microbiological composition of the black stain is thought to be dominated by Actinomycetes[25,26].

The black stain is suggested to be an insoluble ferric compound, probably ferric sulfide formed by the interaction between hydrogen sulfide produced by bacteria and iron in saliva or gingival fluid [12,14,18,27,28]. Chemical analysis using wavelength dispersive spectrometry showed corresponding areas of high concentration of sulfur and copper/iron. This may suggest that sulfur and metal ions form intensely colored compounds [29].

Black stain has many factors associated with its formation. Few authors attempted to find correlations between gender, age, diet, socioeconomic status, medications, and black stain prevalence. Some studies showed no association between black stain and gender[18,22,27,29].

However, the occurrence of black stain was found to increase with age, yet, this correlation was not statistically significant [18].

Consumption of vegetables, fruits, dairy products, eggs, and soy sauce was also found to promote black stain development [18, 30] .

A study conducted in Brazil also showed that drinking tap water instead of bottled mineral or natural well water also seems to be associated with higher prevalence of black stain [28].

Researches about the influence of socioeconomic status on stain formation are controversy. Some authors showed that parent's low educational level was associated with higher prevalence of black stain [28].Whereas; others reported contrary findings [18].Iron supplementation during pregnancy and in childhood may also promote black stain development [30, 31].

Indications for using iron supplements in children:

Adequate iron intake by newborn infants is necessary to support the expansion of red blood cells, which are responsible for producing hemoglobin, an oxygen carrying molecule important for infant growth. Commercially available infant formulas are fortified with iron in order to augment iron stores and prevent the