Dental erosion: a complication of Pervasive Developmental Disorder

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A young teenage male presenting for a routine check-up reported no health problems. Initial clinical examination revealed some enamel loss on the palatal surfaces of the maxillary incisors. Erosion lesions were suspected. Similar lesions, however, were not found throughout the mixed dentition and radiographic findings were inconclusive. To confirm the diagnosis of these lesions and, more importantly, to disclose the etiology, a thorough and detailed clinical examination of these lesions was conducted. Study models were made, mounted in centric occluding position, and closely screened. In addition, the health history was revisited, by interviewing the patient and his legal guardian. The information gathered led to the conclusion that the lesions in question were erosion lesions with concomitant wear facets that resulted from attrition of the softened enamel surface. An ample light on the possible etiological factors was shed, which assisted in the planning phase for the course of management. It is not uncommon that dental health care providers encounter in daily practice cases of early erosion lesions similar to those reported here. In most of these instances, minor changes in tooth morphology that represent a slight departure from the norm could be overlooked and often ignored. If such lesions go undetected, the underlying causes may escape diagnosis. However, if action is taken to pursue investigation of the causative factor, the result could assist in understanding the overall complexity of the health condition of the patient. This would enable planning the proper course of management for the total well being of the patient.
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INTRODUCTION

Erosion lesions with multi-causative etiology are signs of dental hard tissue disease that has become commonly evident in today's society.[1-9] The incidence of erosion lesions are no longer limited to any particular age group, as manifestations can be detected throughout the entire life span. Epidemiological surveys reported high incidence of dental erosion lesions among pre-school children and adults of all ages, while the percentage of the incidence peaks among the teenage populations.[10-14]

Because of the multitude of etiological factors of dental erosion and the complexity of the interaction, early recognition and identification of these lesions is imperative. Causative factors may vary from extrinsic sources such as environmental or dietary habits, intrinsic source such as systemic disease, or could be secondary to psychosomatic disorders. Investigation of the possible causative factors could assist in identifying the underlying problems. Subsequently, an overall plan for the total care of the patient can be implemented.

This communication presents a typical example of such a scenario, highlights the importance of early recognition of possible erosion lesions, describes the approach taken to conclude the finding, reviews the differential diagnosis, and discusses the proposed management.

CASE STUDY

A twelve-year-old black male, native of Philadelphia, presented for an annual check-up and comprehensive care at the Pediatric Dental Clinic of Temple University School of Dentistry. His grandmother, the legal guardian, and his six-year-old younger brother accompanied him. During the routine registration, the grandmother completed the response to a written health history questionnaire, and signed the consent form for the treatment. From her response, she indicated that systemic and dental health of the child was good and that he had never been hospitalized. There was no indica-

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tion that the patient was under any medical care. Since his dental appointment last year there has been no change in his general health condition. She stated that the child had not been taking any medications during the past six months, and there was no history of allergic reaction of any kind to medications such as antibiotics, dental anesthetics, aspirin, codeine or other narcotics. Furthermore, the social history of the child claimed to be free from tobacco, alcoholic beverages and recreational drug use, addiction, or recovery.

The first permanent molars were treated with fissure sealants three and half years ago. At the following six-month recall the same treatment was repeated for the two maxillary molars, in addition to routine oral prophylaxis and topical fluoride application. During subsequent recalls, the patient failed to show.

During the current visit, intra-and extra-oral examinations were followed by topical fluoride and prophylaxis therapy. A superficial loss of enamel from the lingual surfaces of maxillary anterior teeth was observed. These lesions were diagnosed as erosion lesions associated with the excessive use of sour candy. The attending dentist communicated this finding to the patient and his legal guardian, who were advised to reduce the consumption of sour candy. To confirm the preliminary diagnosis and validate the etiology, a second opinion was sought. In an attempt to diagnose these lesions and disclose the causative factor, the health history of the patient was revisited, by interviewing him and his legal guardian. A thorough clinical examination of the patient was conducted. Intra-oral radiographs were taken and study models were constructed from alginate impressions, and were closely examined.

HEALTH HISTORY

This child is the oldest of his siblings, two sisters and the youngest brother, six years old. This patient was delivered to a cocaine-abusing mother, hence the medical term "crack-baby" that identifies this group of newborn babies. At his birth, the mother gave custody to her mother. The grandmother took the legal guardian responsibilities of the four children in the family. She stated that the child was born with drug addiction through the cocaine-contaminated maternal blood. The use of alcohol and tobacco smoking by the mother were not mentioned, although the association was not denied. Since his birth at Temple University Hospital this child was under the care of a pediatrician, who had initially diagnosed him with Attention Deficit Health Disorder. However, after necessary investigative processes, at three years of age, it was concluded that the child is suffering from Pervasive Developmental Disorder (PDD). Accordingly his physician prescribed two medications: Adderall*, 20mg, a long acting tablet, to be taken in the morning for the control of PDD, and Clonidine**, 1mg tablet, for hypertension to be taken before retiring. At about three to four years of age, the child was referred to psychiatric care and continued to receive this service until now. The psychiatrist renews the prescription of the anti-depressant medication, Paxil***, 10mg tablet that has been taken daily for the past eight to nine years.

This patient has continued to suffer from signs and symptoms of nervousness as manifested by spontaneous irritability, abdominal cramps, and have consequently developed an esophageal acid reflux. This psychosomatic condition occurred frequently and has gotten increasingly worse since the child began elementary school, although his grades are above average. The legal guardian claimed that the competitive school environment imposed an added stress that made it difficult for this child to cope. Subsequently, he began to develop two distinctive personalities, one of a normally behaving quiet shy reclusive child, while the other is of a very irritable, raging character.

The oral home care of the patient was described as being fair, since he cleaned his teeth with a medium bristle brush and used tartar control toothpaste. Frequently, he suffered from dryness of the mouth and occasional soreness at the corner of his lips.

Against the aforementioned backdrop of the psychosomatic problems, the abnormal dietary habits took precedence for discussion. The highlight of his diet is the abstention from eating fruits, vegetables, or any meat including beef and chicken. When forced, he only eats small amounts on a rare occasion, although he consumes considerable amounts of starchy foods, such as bread, rice, noodles and cakes. He loves cola-type beverages and drinks approximately four cans a day. This is in addition to other fruit-flavored drinks that come in pouches, such as Tang, Capri, and Kool-Aid****. Noticeable to his family is the habitual uncontrolled consumption of sour candies, such as sour starburst, tropical candies,***** and sour-jellybeans******. He often hides candy around the house and keeps it in his mouth when he goes to bed. The legal guardian reported that the six-year-old younger brother started displaying identical signs and developing similar behavioral patterns to that of his older brother.

CLINICAL FINDINGS

The clinical examination revealed normal head and neck with no adverse signs or symptoms except for a relatively narrow circumference of the head. His skin appeared pale and ashy, with loss of vitality. This teenager seemed to be non-communicative and responded with very few words to any question. It was noticeable that the eyes always looked down and never at the person communicating with him. His weight is below average for his age group. During the clinical examination he persevered with no complaint. However, his tolerance level started to fade during various recording procedures.

Intra-orally, all maxillary and mandibular permanent incisors, canines, premolars, and first molars were

Figure 1. Frontal view shows the unaffected patient dentition.

Figure 2. Lingual view of maxillary anterior teeth that showed faint clinical signs of enamel erosion.

Figure 3. A dental stone model clearly displays the erosion lesions affected the anterior maxillary segment.

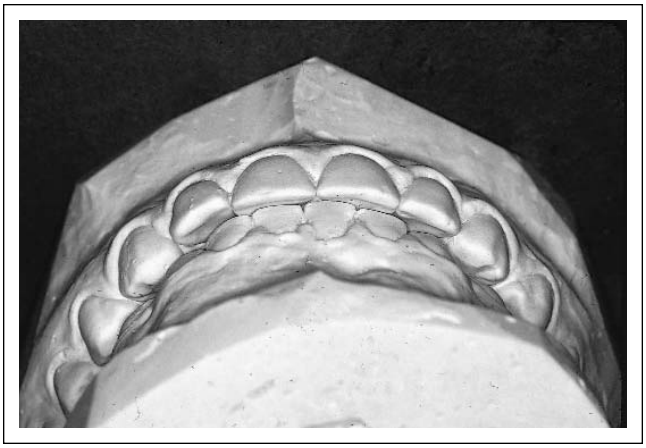

Figure 4. Articulated maxillary and mandibular models demonstrate the contact points in occluding position.

present. The primary predecessor of the right mandibular second pre-molar was still in function and the contra-lateral premolar had just erupted. Both maxillary molars had stained occluso-lingual fissures. The gingiva showed sporadic areas of marginal gingivitis, with some facial recession related to the mandibular incisors. There was little plaque and calculus deposits on these teeth. The maxillary and mandibular arches occluded in a class 1 relationship according to Angle classification. The anterior segment of the arches displayed an overjet and overbite about three millimeters each (Figure 1). The midline and the spacing between the teeth were normal, typical for this age group, with no cross bites.

The morphological features and anatomic landmarks of the mixed dentition appeared normal except for the lingual surfaces of the anterior maxillary incisors (Figure 2). These surfaces displayed lesions that were symmetrical relative to the midline. The affected surfaces of the involved teeth exhibited a smooth, cupped-out appearance with total absence of all anatomic landmarks including the cingulum. The smooth, shiny enamel surface was normal in color, translucency, and vitality. No signs of similar lesions existed anywhere else in the dental arches. The absence of enamel decalcification and carious lesions was noted.

STUDY MODEL EVALUATION AND RADIOGRAPHIC FINDINGS

The study models were mounted on an articulator in centric occluding relation, soaked in water and superficial moisture was removed. Examination was conducted under variable light intensity and positioning. This method was necessary to produce sufficient shadows to disclose morphological details of the examined surface. Evaluation of the stone models clearly identified enamel loss on the lingual aspects of maxillary central and lateral incisors (Figure 3). It also disclosed several wear facets on the mesial and distal marginal ridges of the two maxillary central incisors, the mesial marginal ridge of the two lateral incisors, and the two canines. These oval-shaped wear facets averaged three by two

millimeters by one half millimeter in length, width, and depth. The cusp tips of the maxillary and mandibular canines and three of the maxillary premolars showed a slight wear. When the mounted models were examined, the wear facets and attrition of cusp tips were correlated to the position of the opposing dentition in centric and excursive movements (Figure 4). Radiographs of the anterior teeth did not reveal any significant changes.

DISCUSSION

At the onset of the dental visit by this child, an incomplete and non-precise response to the health history questionnaire was given. Perhaps this was due to the under estimation of the role of the medical, psychological, nutritional, and social habits relative to the dental health condition by the legal guardian. This could have also been the case, since the sole purpose of the visit was a check-up and a cleaning, while no pain or emergency symptoms were reported. When the suspected diagnosis of enamel erosion and clinical significance were shared with the patient and his grandmother, it emphasized the necessity to freely disclose all relevant information. Concomitantly, the course of the dental visit objective has changed. Only then, were efforts made to assist the dentist in the determination of the causative factor of the discovered lesions, and to find the proper course of management. A wealth of information was revealed from revisiting the medical health history and re-examination of the patient clinically. These, along with the findings from detailed interpretation of the study models, established the nature of these lesions and confirmed the preliminary diagnosis. The task remaining was the disclosure of the etiology of the erosion lesions, which may be revealed through interpretation of available facts.

The medical history established that the patient was born a "crack baby". This term came into use during the mid-1980s when an alarming rise in the number of drug-exposed newborns was witnessed.[15] According to Norris and Hill[16], crack babies have become a major national problem. It was estimated that 100,000 were born each year in the United States. This is directly attributable to the rise in the abuse of cocaine and its highly addictive smokable derivative known as "crack", by pregnant women.[17] Cocaine abuse by pregnant women was found to have serious implications on their health, and could also mean lasting problems for their babies.[16-20] Adverse health effects associated with intrauterine cocaine or crack exposure were manifested at birth by reduction in length, weight, and head circumference of infants.[21] The cumulative brain damage during infancy could lead to reduction in brain volume, abnormal behavior, disturbed neuro-endocrine regulation, and poor cognitive outcomes during childhood and adolescence. It may also contribute to central nervous system abnormalities.[22] Accordingly, crack babies may display patterns of both excitability and lethargy, appear to be more stressed, and fail to respond to certain stimuli. Some crack children exhibit extreme mood swings, difficulty sleeping, aggressive behavior, fearfulness and anxiety or nervousness. The slightest disruption often sets off a temper tantrum.[23, 24]

The patient reported here had displayed some of these traits that were identified as attention deficit hyperactivity disorder (ADHD). However, at a later stage of childhood, his condition was diagnosed as pervasive developmental disorder with displayed destructive behavior (PDDs). This term refers to a group of conditions that involve delays in the development of many basic skills. Most notably is the ability to socialize with others, to **c**ommunicate, and to use imagination. Children with these conditions often are confused, have problems understanding the world around them, have difficulty concentrating and may have poor coordination. Most children with PDDs have specific problem areas and often function very well in other areas.[25] To manage the patient's condition, three medications were prescribed. These were Adderall 10mg tablets, Paxil 10mg tablets, and Clonidine 1mg tablets.

Adderall is an amphetamine that has a high potential for abuse and after prolonged use may lead to drug dependency. This medication is claimed to have a stabilizing effect in children with behavioral syndrome characterized by the following group of developmentally inappropriate symptoms: moderate to severe distractibility, short attention span, hyperactivity, emotional liability, and impulsivity. The adverse reactions of this drug constitute gastrointestinal disturbances, dryness of the mouth, unpleasant taste, diarrhea, constipation, anorexia or weigh loss, and possibly urticaria.

The second long term used medication Paxil is an orally administered antidepressant. Its efficacy in the treatment of social anxiety disorder, obsessive compulsive disorder (OCD) and panic disorder (PD), presumed to indirectly inhibit neuronal re-uptake of serotonin. Among the adverse reactions is dry mouth.

The third medication, Clonidine, is indicated for the treatment of hypertension. The systemic adverse reactions vary from dry mouth and throat, nausea, change in taste, gastrointestinal anorexia, vomiting, constipation, localized skin reactions, fatigue, headache, lethargy, insomnia, dizziness, drowsiness, and impotence/sexual dysfunction. Nervousness, fever, malaise, weakness and pallor may also develop.[26] Both the symptoms of the underlying psycho-medical problems and the side effects of the medications used to control these symptoms may have adversely contributed to gastrointestinal disturbance and dryness of the mouth of the patient. Consequently, nausea, abdominal cramps, vomiting, and esophogial reflux of gastric acids developed. These were in addition to anorexia, infrequent localized skin reactions, and changes in taste. The latter two predisposed the need of the child to constantly suck on sour candy and drink

fruit juices and carbonated soda throughout the day. The sour candies contain, in addition to the refined sugar, various organic acids such as citric, ascorbic and malic acids. Both the fruit juices and carbonated beverages consumed by the child also have acid contents.[27]

It is unfortunate in this case, as possibly in many similar cases, that the lack of proper nutritional awareness often leads to the intake of the wrong food and beverages. This child excessively and exclusively consumes food and beverages with high carbohydrate and high acid contents, as a substitute for water, moderate intake of natural fruits, and protein-based meals.

The combined erosive effects of acid reflux and continued use of acid-containing sour candy, and consumption of acid contained fruit juice and carbonated beverages, have contributed to enamel decalcification. This along with the two and/or three body wear mechanisms at the incisor region lead to the subsequent formation of erosion lesions and attrition as noted from the clinical findings and study models.

The lingual aspect of the maxillary incisors afflicted with erosion lesions, is the primary target for the stomach acid during a sudden, involuntary, violent reflux episode. The mechanism of resultant erosive action and the outcome are similar to those occurring from voluntary purging of stomach contents by bulimic patients.[5, 6] In both cases, the erosive effect of acid starts at the midline, fans out laterally to involve adjacent teeth of the anterior segment of the maxillary arch and, at a later stage, could involve those of the mandibular arch. The decalcified enamel is continuously removed by the three-body wear, leaving smooth, shiny, translucent enamel surfaces denuded of all morphologic features.[5] The wear facets observed on the study models were believed to have resulted from two-body wear of the softened enamel during masticatory function. The location of the erosion lesions is also a natural position for a piece of candy to come in contact with, during the sucking process. The constant use of acid-containing sour candies throughout the day, and in particular, keeping it in this position while going to bed, has significant erosive potential on enamel.

Isolating the responsibility of one factor alone among the reflux of gastric acid, high acidic contents of consumed candies, and acidulated beverages intake, could prove to be difficult, since several factors can influence the outcome of the erosive effect of acids, either from extrinsic or intrinsic sources. The most crucial of these are: 1) the pH level induced *in situ* by the said acid; 2) the duration of time this level is maintained; 3) the frequency of reducing this pH level in situ to or below pH 5.4 suitable for the dissolution of hydroxyapatite; 4) the longevity of this occurrence; 5) the oral musculature; 6) the presence of saliva with its neutralizing action; and 7) the oral hygiene regiment. Also playing a major role in the identification of the causative factors are the location, distribution, and severity of the erosion lesions. Based on the pattern of the erosion lesions in this case, the lesion characteristics, and their location, it can be concluded that the combined influence of acid reflux to a large extent and acidic content of sour candies were the prime etiology. The absence of any sign of erosion lesions anywhere else, particularly the white decalcified enamel, associated with carbonated soda, precludes the influence of this acidic beverage, at this stage.

PROPOSED MANAGEMENT

The moderate loss of enamel and the absence of exposed dentin in this case precluded the necessity for restorative intervention. The course of management is, therefore, aimed at preventive measures that may be achieved through multiple approaches to be implemented simultaneously. The first approach is to strengthen the enamel and render it acid resistant. For this goal, topical application of sodium fluoride gel 1.1%, fluoride mouth rinse, and fluoride containing toothpaste on a soft brush are recommended. The second approach is nutritional counseling to provide instruction for a balanced diet with low carbohydrates, high protein, fresh fruits, and vegetables. The use of sour candy and intake of acidulated beverages should be substituted by sugarless gum and plenty of water as an integral part of the patient treatment. Regular monitoring of the condition of the child at six monthly intervals should be emphasized.

As for the third approach, the pediatrician and psychiatrist may consider alternatives to medications. In lieu of which, other remedial measures such as aerobic or physical exercises, psychological counseling as an individualized intervention protocol, educational programs for special needs, and social activities with guided supervision may prove to be useful. Since the single most important predictor of neonatal outcome is the frequency, quantity, and type of cocaine used by a pregnant mother, the ultimate prevention approach should target women in child-bearing ages and drug-abusing mothers early in pregnancy.[21,26] If the drug abusing women were not rehabilitated, post-natal care and the proper rearing of these vulnerable babies could have positive outcome.[23] This emphasizes the importance of early diagnosis of the condition of the child by means of psychological investigation in combination with a neuro-physiological and motor examination.[24] It is disappointing to witness that the newborns of most crack-using mothers are likely reared in environments of poverty, violence, and poor parenting. Babies that twitch, cry or act fussy can further influence how parents treat the baby.[23]

Due to the exponential increase in the number of crack babies in the United States, this phenomenon has reached an epidemic proportion. It is estimated that between 375,000 to 700,000 crack babies are born annually.[28] Kobre[28] also reported in May 2003 that

neither the Department of Health and Human Services nor the Department of Education has yet to set up a comprehensive preschool intervention program. This serious national crisis urges the need for federal legislation to appropriate sufficient funds that are adequate to support the targeted prevention programs. This legislation would be paramount in order to circumvent the inevitable consequences of the crack-babies epidemic for the newer generations.

CONCLUSION

Attention to minimum details during clinical examination cannot be over-emphasized. The use of study models to substantiate clinical findings is highly recommended. Whenever erosion lesions are suspected, the medical health history must be revisited. Collectively, the information gathered would enable an informed discussion of differential diagnosis. This is in order to disclose the possible etiology of these lesions, and plan appropriate measures for the total well being of the patient.

MANUFACTURERS:

* Adderall: Shire US Inc. Florence, KY 41042

** Clonidine: Boehringer Ingelheri, Richfield, CT 06877

*** Paxil: Smithkline Beecham Pharmaceuticals, Philadelphia, PA 19101

**** Tang, Capri, and Kool-Aid: Craft foods Inc. Whiteplains NY 10625

***** Starburst and Tropical candies: MMM-Mooris Div. of Mooris Inc. Hacketts town NJ 07840

****** Sour-jellybeans: The original Jelly Bean Factory Burbank CA 91505

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