ON THE EVALUATION OF THE CONSEQUENCIES OF ACID DRINKS CONSUMPTION

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Abstract

Even if, in the manifestation of dental erosion, intrinsic factors are often mentioned, in the contemporary society, extrinsic factors, such as consumption of sweet carbonated drinks and acid fruit juices, are more and more frequently viewed as responsible for this affection. The scope of the present study is to evaluate the alimentary habits related to the consumption of acid drinks and to its effects on a group of patients who had addressed the Odontology-Endodontics Clinic of the „Apollonia” University of Iași between October 1, 2011 – April 1, 2014. The group of patients included in the study was formed of 167 men and women, previously examined both clinically and radiographically, on the basis of an original questionnaire, for the identification and establishment of the positive and differential diagnosis of erosive lesions, as well as of the degree of interdependence with the etiological factors. Loss of dental structure at erosion level was quantified by means of the TWI index described by Smith and Knight. Consumption of acid drinks causes erosive phenomena of acid etiology, and multiplies caries and abrasive-type lesions. Specific measures should be taken by the patients for reducing the acid attack, such as avoiding to brush the teeth immediately after the consumption of acid aliments, drinks, citrics and fruit juices, rinsings with fluorurated solutions and utilization of sugar-free chewing gums, as they may stimulate remineralization.

Keywords: acid drinks, dental erosion, enamel demineralization, odontal diagnosis.

1. INTRODUCTION

Dental erosion is defined as a pathological, chronic, localized, non-painful loss of hard dental tissue, caused firstly by a chemical, non-bacterial attack, usually involved being acid substances [1]. According to some authors [2,3], dental erosion or erosive dental wear is caused by a chronic loss of hard dental tissue, which is chemically dissolved off the tooth with an acid and/or chelating agent with no bacterial involvement.

Even if, in the manifestation of dental erosion, intrinsic factors – such as bulimia, anorexia and gastro-intestinal disorders with gastric acid reflux [4] are more and more frequently mentioned, in the contemporary society, extrinsic factors, such as consumption of sweet carbonated drinks and acid fruit juices are also viewed as responsible for this affection.

Over the latest decades, the decreasing prevalence of dental caries all over the world has been accompanied by a remarkable increase of the incidence of other non-caries diseases, such as dental erosion, known as causing an irreversible loss of dental structures. Recently, a significantly higher level of the consumption of cooling drinks and ready-made fruit juices has been observed worldwide. More than that, fresh drinks are more and more present in feeding bottles, as well, being therefore introduced in the diet of babies [5]. This explains the paradox we are now facing, namely a reduced caries incidence – as a result of the application of successful prophylactic programs – along with an increased incidence of lesions at the level of dental crowns, if considering the long-term complications brought about by the dental erosion induced by the consumption of sweet acidulated beverages which, in most of the cases, provoke carious processes.
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2. MATERIALS AND METHOD
The study was performed on a group of 167 patients, men and women, from urban and rural areas, with ages between 16 and 57 years, who had addressed the Odontology-Endodontics Clinic of the „Apollonia” University of Iaşi between October 1, 2011 – April 1, 2014 (42 months).
They were examined both clinically and radiographically, on the basis of an original questionnaire, for the identification and establishment of the positive and differential diagnosis of the erosive lesions, as well as of the degree of interdependence with the etiological factors.
Analysis of these cases provided the data basis necessary for statistical processing, and for the determination of the basic pathogenic factors, of the risk of erosive pathology manifestation. In this respect, the MS-Office program (organization of data as graphs) was utilized.
For the establishment of certain clinical aspects related to erosion, of special importance are the etiological factors, for whose determination a questionnaire has been elaborated.
The loss of dental structure at erosion level was quantified by means of the TWI index described [6] by Smith and Knight (1984).

<table>
<thead>
<tr>
<th>Score</th>
<th>Surface</th>
<th>Clinical significance</th>
</tr>
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<tbody>
<tr>
<td>0</td>
<td>V, O, I, Oc</td>
<td>No loss of the surface characteristics of email</td>
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<tr>
<td></td>
<td>C</td>
<td>No contour modification</td>
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<tr>
<td>1</td>
<td>V, O, I, Oc</td>
<td>Loss of the surface characteristics of email</td>
</tr>
<tr>
<td></td>
<td>C</td>
<td>Minimum contour modification</td>
</tr>
<tr>
<td>2</td>
<td>V, O, Oc</td>
<td>Enamel loss with slight dentin exposure over &lt;1/3 of the surface</td>
</tr>
<tr>
<td></td>
<td>I</td>
<td>Enamel loss slightly exposing the dentin</td>
</tr>
<tr>
<td></td>
<td>C</td>
<td>Depth defect &lt;1mm</td>
</tr>
<tr>
<td>3</td>
<td>V, O, Oc</td>
<td>Enamel loss with slight dentin exposure over &lt;1/3 of the surface</td>
</tr>
<tr>
<td></td>
<td>I</td>
<td>Enamel loss and substantial loss of dentin, yet without pulp exposure</td>
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<td></td>
<td>C</td>
<td>Depth defect of 1-2 mm</td>
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<tr>
<td>4</td>
<td>V, O, Oc</td>
<td>Complete loss of enamel, pulp exposure or exposure of secondary dentin</td>
</tr>
<tr>
<td></td>
<td>I</td>
<td>Pulp exposure or secondary dentin exposure</td>
</tr>
<tr>
<td></td>
<td>C</td>
<td>Defect with a depth &gt;2mm, pulp exposure or secondary dentin exposure</td>
</tr>
</tbody>
</table>

*V=vestibularly (maxillarly/mandibularly), O=orally (maxillarly/mandibularly), I=incisally, Oc=occlusally, C=cervically

The patients selected for the study have been subjected to the following clinical algorithm:
- clinical examination;
- determination of the degree of dental hygiene;
- establishment of treatment strategy;
- estimation of treatment’s efficiency.
3. RESULTS AND DISCUSSION

Presented in the following are the characteristics of the experimental group (Fig.1).

As shown in the figure above, most of the patients belonged to the 20-29 year (60%) and, respectively, 10-19 year (27%) category of age. This situation was quite expected, as both authors’ observations and the literature of the field show that these categories of persons record the highest consumption of carbonated drinks. The younger ages (16 years) at which lesions of erosive type have been observed indicate their expansion in teenagers and young adults.

Evaluation of the economic status of the persons included in the study showed that most of the subjects have average and high incomes, 128 among them (77%) having high incomes, 36 patients (21%) declaring average incomes, while only 3 (or 2% of them) have a low socio-economic condition (Fig.2).

As known, the material condition of the subjects has a direct influence upon the consumption of acid beverages, as most of these aliments are intensely processed products, sold especially in the urban areas at quite high prices, which makes them less accessible to a person with a poor economic situation.

Clinical evaluation performed according to the subjective symptomatology observed registered the following complaints: dentin hyperesthesia in 72 patients, which represents 43% of all painful affections, hypersensitivity in 83 patients (50%), and pain on stimulation in 12 patients (7%) (Fig.3).

Equally, all patients mentioned a more or less visible physignomic prejudice, caused by the erosive loss of dental substance or by its complication with enamel and dentin caries (Fig.4.a, b.).
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As to the type of observed lesions (fig. 5), the distribution of subjects shows that, in 48 patients, acid erosions were prevailing (29%), 41 patients suffered from carious lesions on surfaces generally not exposed to caries (Fig. 4.b), in 21 persons (13%) zones of enamel demineralization were found, while 25% of the patients (42 persons) showed combinations of the 3 forms of lesions. In spite of their subjective symptomatology, especially hyperesthesia, and also in spite of the consumption of acid drinks or juices, no modifications were evidenced in 15 patients.

Also, consumption of acid drinks has as a direct consequence the occurrence of erosive phenomena of acid etiology, intensification of the carious lesions and of the abrasive-type ones (Fig. 5).

A relation of direct causality exists between the consumption of acid-type drinks and the phenomena of dental erosion, as demonstrated by the high incidence of this type of lesions, as well as by an increased carious activity. An important part of the consumers of acid drinks may experience, in parallel with erosive phenomena, carious lesions, as well. The sugar–acids associations are more dangerous than the presence of a single acid. The Fanta-type juice contains acetic acid, citric acid and sugar. The juices obtained from fresh fruits – such as citric, apple, quince, grapes, plum juices - contain, besides acetic acid, a considerable amount of ascorbic acid. A daily, or even a twice a week dose does influence the organism. A 330 ml dose of juice contains the equivalent of 7-10 teaspoons of sugar.

The phenomena of dental hyperesthesia and hypersensitivity, which occur prior to erosion, should be an alarm for the persons affected by such manifestations, determining them to address the dentist, for identifying the causes and also for amending the symptoms.

A partial analysis of the answers provided by the questionnaire, related to the evaluation of acid drinks and aliments preferred by consumers, led to the following observations.

Study of the consumption of acid drinks shows that the type of acid beverage influences directly installation of erosive-type phenomena (Fig. 6), so that, out of the 167 subjects included in the present study, 126 consume carbonated-type drinks, 107 (60%) of them consume carbonated juices, comparatively with only 13 subjects (7%) who consume natural juices. Apart from this, 42 subjects consume energizing drinks with vodka (19 patients - 11% and, respectively, wine or beer, 23 patients - 13%). The remaining patients (15) consume other combinations of drinks, in which the acid ones are nevertheless prevailing.
Analysis of the consumption of carbonated-type drinks (Fig.7) evidences the following aspects: out of the 126 subjects, 71 prefer Cola (56%), 32 consume preferentially Pepsi (32%), 13 consume mostly Fanta Orange (13%), a number of 7 subjects consume Red Bull-type drinks (6%) and only 3 subjects have other preferences (2%).

![Fig. 7. Analysis of the consumption of carbonated-type drinks](image)

Especially important was also the analysis of the frequency of acid drinks consumption, once knowing that an increased frequency of carbonated drinks consumption produces acid erosions, enamel demineralization and contributes to a rapid evolution of incipient carious processes.

Out of the evaluated subjects, more than a half (91 persons) declare they consume acid drinks at least once a day, 59 persons - 2-3 times/day or even more frequently, drinks with demineralizing potential, and only 10% (17 patients) declare an occasional consumption of acid beverages (Fig. 8).

![Fig. 8. Analysis of the frequency of acid drinks consumption](image)

The therapy of the lesions caused by acid drinks consumption differs, as a function of symptomatology and extent of disease of the dental structure. According to the therapy applied, the patients of the experimental group were divided into:

- 52 patients with desensitisation therapy
- 47 patients with restaurative therapy
- 68 patients with mixed therapy

The phenomena of dentin hypersensitivity and hyperstesia have been improved by the application of UltraEZ (Ultradent), a desensibilizing gel with continuous release, which contains potassium nitrate (3%) and natrium fluoride (0.25% NaF). The product is utilized in silicone trays applied in the oral cavity for 30-60 min, in one or two sessions, as a function of symptoms severity. The UltraEZ gel was applied to patients suffering from erosive-type lesions with no loss of dental substance.

The applied therapy, of either desensitisisation or restaurative type, attenuated the painful manifestations and restored the aesthetic function of the patients included in the study. The therapeutic methods associated with the reduction, or even complete giving up, of acid drinks consumption increased the degree of masticatory and aesthetic confort of patients (Fig. 9).

![Fig. 9. Attenuation of painful manifestations and restoration of the aesthetic function in a 23 year-old, heavy Coca Cola consumer patient](image)

The efficiency of the treatment applied in cases of lesions caused by acid drinks consumption may be estimated in the following manner:

- in 39 patients, the aesthetic aspect was improved;
- in 51 patients, the masticatory function was improved;
- in 56 patients, both the aesthetic aspect and the masticatory function were improved;
- in 21 patients, dentinary hyperesthesia was meliorated.

As recent studies evidenced the association between a more rapid erosion progress in cases of frequent consumption of acid drinks and the consumption habits, the patients under analysis received information on the detrimental effect of acid drinks upon dental integrity, as well as some pieces of advice for reducing the unpleasant effects as much as possible.

For example, prolonged preservation of beverages in the mouth causes a considerable decrease of pH [7]. Also, the frequent consumption of some acid drinks, accompanied by a shorter time necessary for salivary clearance, may cause deeper erosions [8]. At the same time, the effect is intensified when raising the temperature of the acid drink [9].

Brushing is a method for assuring a good oral hygiene. However, tooth brushing applied immediately after the consumption of acid drinks intensifies the loss of hard dental tissue [10,11], which explains the recommendation addressed to our patients of brushing their teeth at least 30 min after an erosive attack, for protecting the integrity of both enamel and dentin [4].

Special attention should be also paid to the type of toothpaste employed, once known that it may accelerate erosion through elimination of the superficial enamel layer [10]. Whitening toothpastes containing fluorine should be avoided, as they provoke an excessive wear of both enamel and dentin [12,13]. On the contrary, the fluorine-containing and remineralizing pastes (which contain NaF, calcium, phosphate and fluorine ions) may efficiently inhibit enamel erosion [14].

Specialists stated that a fluorine concentration of $1100 \times 10^{-6}$ in toothpastes may contribute to reducing wear phenomena [11]. The remineralizing tooth paste is more efficient for the intact, decalcified enamel [12,15].

The patients here under investigation have been informed that an excessive consumption of cooling drinks might have complex consequences, including dental erosion and caries. In spite of their different histological aspect, the two concomitant conditions might negatively affect the hard dental tissues.

Some studies have demonstrated that, to reduce acid aggression, calcium and fluorine compounds should be added in acidulated drinks [16]. A good example in this respect is provided by the Smoothie-type drinks made of fresh fruits or vegetables in combination with diary produces, whose calcium ions may counteract the acid effect, thus contributing to enamel remineralization.

Patients should be informed and educated on the detrimental effects of an excessive consumption of cooling drinks, and also advised to prevent dental erosion and caries by: a reduced consumption of acid drinks, selection of cooling drinks with a reduced erosive effect, improved habits of consumption, tooth brushing at least twice a day, yet not sooner than 1 hour after the consumption of acid aliments, utilization of fluoride-containing or remineralizing toothpastes [17].

4. CONCLUSIONS

The direct consequence of the consumption of acid drinks is the manifestation of erosive phenomena of acid etiology, and intensification of the carious and erosion type lesions.

Most of the patients belonged to the 20-29 and, respectively, 10-19 year categories of age, known as including persons consuming carbonated drinks in considerable amounts.

The young age at which erosion-type lesions have been evidenced in the subjects of the experimental group shows that the process is under development in adolescents and young adults.

The material conditions of the subjects influence directly the consumption of acid drinks.

Study of acid drinks consumption shows that the type of beverage influences directly the occurrence of erosive-type phenomena.

The necessary measures capable of reducing the acid attack, recommended to the patients, include avoidance of tooth brushing immediately after the consumption of acid aliments and drinks, citrus and juices, oral rinsing with
fluoride solutions and utilization of sugar-free chewing gum after consumption of acid aliments or cooling drinks, once known that they stimulate remineralization.

References

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