DENTAL FLUOROSIS – A FAST GROWING PROBLEM OF THE MODERN AESTHETIC DENTISTRY

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Dental fluorosis is attributed to the group of non-curious diseases of type one, in other words to a group of disorders developing prior to the tooth eruption. Dental fluorosis is produced by the ingestion of excessive amounts of fluoride by a child organism. Fluorosis of the mature dental enamel of a human being is described as the subsurface hypermineralization with porosity, which increases relatively to the severity rate of fluorosis. [1] Agencies and organizations dealing with the population health protection attached different degrees of importance to the problem of dental fluorosis at different times. For instance, the USA Agency for environment protection considers dental fluorosis not as a disease but as a cosmetic defect. The World Health Organization (WHO) attributes dental fluorosis to the diseases which affect millions of people on the whole globe (WHO information, 2001, 2002). [2]

Depending upon the severity degree, dental fluorosis can turn into a grand aesthetic problem torturing a person.

Until recently dental fluorosis has been considered to be an endemic disease associated with the fluoride content in drinking water. A whole body of research works conducted in various countries discovered that the most critical period when fluorosis of the human permanent teeth develops is between 20 and 36 months of the baby’s life. Nevertheless, the results of the investigation carried out by Erdal S. and Buchanan S. N. [2] prove that children of 3-5 years old are significantly vulnerable for dental fluorosis because the risk of the excessive fluoride intake still remains in this age.

Classification of the dental fluorosis severity degrees according to Dean’s fluorosis index:

- **Questionable.** Slight defects of the translucent normal dental enamel ranging from several white tiny specks to occasional white stains.
- **Very mild.** Tiny non-transparent white specks scattered randomly and irregularly upon the tooth surface and covering less than 25% of the tooth surface.
- **Mild.** Areas with white stains on the enamel covering from 25 to 50% of the tooth surface.
- **Moderate.** The tooth surface is prone to the marked erasure with frequent brown stains of irregular shape.
- **Severe.** All tooth enamel surfaces are affected. Extremely marked hypoplasia that can change the entire tooth form. Isolated or confluent pits are the most basic diagnostic sign of this code. Brown stains occur frequently. One can get an impression that a tooth is attacked by the corrosion.

In the course of the last decades the rate of the dental fluorosis prevalence has become substantially higher in the developed countries. Data given in reports on the childhood dental fluorosis prevalence in the North American countries vary and are subject to the status of the drinking water fluorination (Clark, 1994; Mascarenhas, 2000; Riordan and Banks, 1991; Tabari and co-author., 2000). As of 1986-1987 National survey on dental caries, dental fluorosis was found in 22% of American schoolchildren (Brunelle, 1989). According to data received during another survey conducted in 1998 by regional clinics of Boston, it was already 69% of children
aged from 7 to 11 years whose teeth were affected with fluorosis (Morgan and co-author, 1998). In North Carolina where tap water is fluoridated, the fluorosis prevalence amounted to 78% in children (Lalumandier и Rozier, 1995). As of the survey conducted during the period of 1990 – 2000, in those areas where mains water is not fluoridated the fluorosis prevalence ranges from 3 to 45% (Clark, 1994; Mascarenhas, 2000; Riordan and Banks, 1991; Tabari and co-author, 2000).

Taking into consideration the fact that the increase in the dental fluorosis has been registered in many countries, nowadays we have already enough information regarding major risk factors causing the initiation and development of this pathology. It goes without saying that dental fluorosis is a consequence of the cumulative effect produced by the ingestion of fluorides entering a human organism from various sources. Fluoride comprising toothpastes, such toothpaste frequency use, drinking water fluorination, use of fluorine comprising tablets and fluorinated salt can be added to the significant risk factors. For instance, according to information from Erdal S., Buchanan S.N. [2] such sources as fluorine tablets and toothpastes increased the daily fluorine intake (EDI) by 2-6 times among children aged from 3 to 5 years. Being conducted by de Almeida and co-authors [3] the quantitative analysis of fluoride intake among children aged 1-3 years showed that toothpastes containing fluorine in their composition accounted for 81% . It is interesting to know that the quality of education and the level of awareness of the parents also have an impact upon the fluorosis prevalence, but negative at that. It is this category of parents who provide their children with the most thorough oral care [4].

Thus, the fact that the risk of dental fluorosis development mainly depends upon the fluorine content in a children’s toothpaste can be considered to be proved nowadays. For instance, when young children were cleaning their teeth with a toothpaste comprising 1000 ppm $\text{F}^{-}$, the fluorosis prevalence reached the mark of 49% in the region of Halmstad (Sweden) and 4% of children suffered from severe fluorosis forms that turned into a serious aesthetical problem. The recommendation to use a toothpaste with 1000 ppm $\text{F}^{-}$ for babies’ teeth appeared on those grounds that drinking water was not fluoridated in this area [4]. The high rate of the dental fluorosis prevalence was registered in Australia in the early 90s. As a result, a public medical programme had been passed aimed at weakening the risks of fluorosis. Reducing the fluoride content in children’s toothpastes to the level of 500 ppm together with lessening of the toothpaste portion necessary for tooth-cleaning was one of the first steps taken within the framework of the program. Monitoring of the fluorosis
indices dynamics showed that 10 years later the prevalence of the mild fluorosis dropped from 34.7% to 22.1% while the occurrence of the severe forms of the disease (characterized by significant aesthetic tooth defects) changed from 17.9% to 8.3%, in other words it became twice lower. The authors attribute the gradual decrease in values of childhood fluorosis indices exclusively to changes in the mode of the toothpaste use. [5]

Having in mind the experience of other countries and taking into consideration the fact that in Russia the fluorine containing toothpastes started to be widely used comparatively not long ago, we have all grounds to predict the increased prevalence of dental fluorosis as well as the rise in demand for medical treatment of fluorosis caused cosmetic defects and in those cities where patients with such a disease were rare. The examples of dental fluorosis manifestations of various severity degrees are shown in Pictures 1. a, b, c, d, e.

What are the methods of medical treatment of aesthetic defects caused by this disease (only the conventional methods of treatment will be concerned)?

First of all, one should remember that in the international literature the mild forms of dental fluorosis are not considered to be a cosmetic defect at all. We failed to find any publications describing the approaches of removal of such defects in the accessible pieces of international literature. The attempts to whiten the fluorosis affected teeth with peroxide containing systems found that as a result of such dental bleaching procedure the stains could become even more contrasting and noticeable. [6] The opinion that the elimination of such defects is impossible enjoys wide popularity among the dentists on the ground that this dental disorder is caused by the character of mineralization. Fedorov Y.A. proposed to use a remineralizing therapy to cure the above described defects. [7] The clinical case of the successful treatment of the mild form of dental fluorosis was registered by doctor Vedenskaya S.V. (pic. 2). The remineralizing gel named «R.O.C.S. Medical Minerals» had been used as an agent of the remineralizing therapy. Medical treatment of this aesthetic defect by the remineralizing method requires a patient to be disciplined. The duration of the medical course could take 12 months but in the end of it the defect is removed irreversibly.
Fluorosis treatment using the method of remineralizing therapy.
Clinical case described by doctor Vvedenskaya S.V.

a) Patient, 15 years old, with a mild form of fluorosis. Medical treatment started on January 15, 2006.
1 – The areas of the whitened enamel with originally normal transparency of the enamel.
2 – Zones of the renewal of the enamel transparency in the areas of fluorosis stains.

What was done: professional hygiene, personal mouthpieces for gel application were produced.

Recommendations: tablets of calcium glycerophosphate per 1 gram a day during one month; applications of “R.O.C.S. Medical Minerals” gel, wearing mouthpieces daily, twice a day during 15 minutes, for a long period of time; correct the hygienic regime; balance eating habits (fruit, vegetables, dairy products, fish); change a style of life – going info sports, enough sleeping. The patient carried out the recommended medical treatment by herself. The patient completely fulfilled all the recommendations (according to her parents’ comments). The achieved result in the course of a year after treatment (the patient is satisfied with an aesthetic result).

b) Patient, 16 years old, fluorosis, severe form. Medical treatment started on January 15, 2006.
3 – Filled erosive area

What was done: professional hygiene, personal mouthpieces for gel application were produced.

Recommendations: tablets of calcium glycerophosphate per 1 gram a day during one month; applications of “R.O.C.S. Medical Minerals” gel, wearing mouthpieces daily, twice a
day during 15 minutes, for a long period of time; correct the hygienic regime; balance eating habits (fruit, vegetables, dairy products, fish); change a style of life – going into sports, enough sleeping. The patient carried out the recommended medical treatment by herself. The patient did not follow the recommended regime and did not change a habitual life-style (commented by her parents). The achieved results after the treatment during one year (other methods of aesthetic treatment are required).

In case the coloured stains are available on the tooth surface (moderate and severe forms of fluorosis) the method of vital bleaching is used but the preference is given to home methods as the dental enamel is characterized by a porous hypomineralized structure.

As the appearance of dark spots is caused by the penetration of food colouring agents into the hypomineralization areas, spot whitening is ensured due to oxidative breakdown of the food pigments. Nevertheless, in the course of some time the fluorosis stain will get darker again that is why it is believed that the remineralizing therapy should be prescribed and the patient should undergo it during the dental bleaching process and at the end of it to protect such teeth. The possibility of the successful application of the remineralizing therapy in case of moderate and severe forms of tooth damage with fluorosis has been already confirmed by the investigations carried out by the Therapeutic dentistry department №1 of the Saint-Petersburg State Medical University, Medical Academy of Postgraduate Studies (Drozhzhyna V.M., professor, Head of the Department; Fedorov Y.A., professor, Chief scientist). This approach to fluorosis treatment has been also appreciated by D. Besten and N. Giambro (University of California). Data received by them on the extracted teeth with fluorosis showed that applications of the paste comprising calcium sucrose phosphate upon the dental enamel, which had been bleached with 5% hypochlorite, resulted in the renewal of the dental colour and transparence in the fluorosis stain area. [8]

Dental enamel microabrasion is one of the methods of removal of the coloured fluorosis stains. But this method is applicable just for those cases when the depth of the coloured area does not exceed several tenths of the millimetre. [9] Hyperesthesia resulting after dental microabrasion and tooth whitening can be successfully cured with the help of remineralizing gels. [10] In case of more severe forms of fluorosis (erosive form) all the methods enumerated above are prior to further use of veneers and crowns.