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A Clinical Study on Dental Fluorosis with Light-Induced Fluorescence

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Abstract: ***The up-to-date dental caries treatments and preventive strategies are related to several fluoride sources. On the other hand fluoride is present in some nutritional products too. The aim of the present study is to investigate and compare the ability of Quantitative laser fluorescence (QLF) – DIAGNOdent Classic and Light-induced fluorescence (LIF), applied with SoproLife diagnostic camera to diagnose Dental fluorosis in mature human teeth: n= 180, n= 90 front teeth, n= 50 premolars, n= 40 molars, of 9 patients. The suspected for dental fluorosis patients were as follows: four Bulgarians (40 teeth, 4 female patients) from Burgas and five Moldovians (n=140 teeth, 3 female and 2 male patients). All of them were diagnosed with fluorosis according to Luckomski scale. All teeth were exposed to LIF – SoproLife (Acteon, France) in modes "day light" and "blue light" and to QLF – DIAGNOdent Classic (Germany). Moderate and severe dental fluorosis (n = 43 teeth) was diagnosed by QLF-DIAGNOdent Classic device, with scores 99-which indicates dentine caries. Mild fluorosis (n = 137) was diagnosed by DIAGNOdent Classic device, with scores 30-45-56, which indicates dentine caries. DIAGNOdent Classic diagnosed fluorosis as caries lesions. LIF "blue light" also did not recognizes fluorosis from caries lesions. SoproLife "day light" showed a realistic appearance of all tooth surfaces.***

Keywords: Fluorosis, dental caries, diagnostic methods.

1. Introduction

Fluoride sources are well established in the dental literature [11]. The most common sources of fluoride are fluoride tablets, water with more than 1.5-2.0 mg/L fluoride, tooth pastes, fluoridated salts, fluoride topical preventive products and some dental materials, like glass ionomer cements (GIC). Chewing gums, foods like tea and fish, and milk fluoridation are also fluoride nutritional sources [2].

Recently, higher intake of fluoride (F) from different sources was registered in few groups in Bulgaria. Currently in Bulgaria Fluorosis is mostly due to the use of mineral water with more than 1,5 ppm F, although tap water was never fluoridated. In Sofia the region tap water is with fluoride concentration less than 0.3 ppm, which makes it safe for the development of Dental Fluororis. Regions like Burgas, Dimitrovgrad, Hisar are still using tap water with more than 1 ppm F which is increasing the risk of Dental fluorosis. In Moldova tap water is with more than 2 ppm F. In Hungary, Slovakia and Ukraine high-fluoride concentrations in drinking waters and their health effects in the population were followed up in Moldova and Ukraine. Demonstrating Denatal fluorosis prevalence rates of 60-90 % in adolescents consuming water containing 2-7 ppm F is fact in few scientific articles [5,12].

The fluoride ion affects structures with mesenchime origin – dentine, and ectodermal origin – enamel. Fluoride lowers the absorption of non-collagenous proteins and hydroxyapatite and affects the crystal growth. Severe chronic endemic fluorosis, in Eastern Europe, as the one in Moldova, leads to the formation of elongated apatite crystals with low density and heterogenic lay down. Fluorosis can affect the enamel of front teeth, but can also affect all groups of teeth, mainly contra-lateras. The defects emerge in the apatite crystals and in the organic matrix and lead to caries susceptibility. Subsurface enamel becomes hypomineralized with elongated apatite crystals, hypomineralization and porous structures. Changes in dentine includes incomplete mineralization and maturation [14, 15].

The first stage of Dental fluorosis can be easily diagnosed as white spots caries lesions [8]. In these cases all products for remineralization may lead to whitening of the fluorotic teeth.

Accurate diagnosis is related to the clinical status and paraclinical examination of the changes of the structure and color of the surfaces. Riordan described trends in dental practices that practitioners to overestimate the scores of fluorosis [10]. In Bulgaria, dental fluorosis occurrence has been underestimated in the last two decades [3].

2. Aim

The aim of the present clinical in vivo study was to investigate and compare the ability of Quantitative laser fluorescence (QLF) – DIAGNOdent Classic and Light-Induced fluorescence (LIF) – SoproLife camera, to diagnose Dental fluorosis.

3. Materials and Methods

Mature human teeth: n= 180, of them n= 90 front teeth, n= 50 premolars, n= 40 molars, of 9 patients: 4 Bulgarians (40 teeth, 4 female patients) from Burgas and 5 Moldovians (n=140 teeth, 3 female and 2 male patients) were clinically diagnosed with Dental fluorosis according to Luckomski scale. All teeth were exposed to LIF-SoproLife (Acteon, France) in modes "day light" and "blue light" and QLF-DIAGNOdent Classic (Germany).

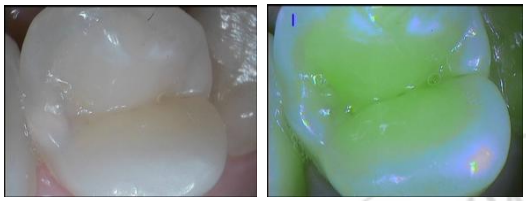
Classification of Luckomski -1947, currently in use in the Faculty of Dental Medicine-Sofia [4,8]
1. White spots or tiny strips
2. White-yellow spots or tiny strips
3. Yellow-brown spots or strips
4. Brown-black spots in enamel

4. Results

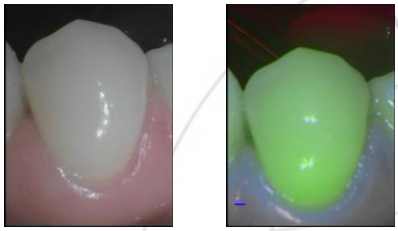
Moderate and severe Dental fluorosis (n = 43) were diagnosed with Quantitative laser fluorescence by QLF - DIAGNOdent Classic device, with scores 99 and recognized as dentine caries. Mild fluorosis (n = 137) was diagnosed by DIAGNOdent Classic device, with scores 30-45-56, which indicates dentine caries. LIF "blue light" also did not recognize fluorosis from caries lesions. SoproLife "day light" showed a realistic appearance of all tooth surfaces. Fig. 1 (a-e) Ten images of sound enamel and fluorotic teeth with SoproLife camera in the "Day light" mode and "Blue light" mode

Sound enamel : occlusal surface and buccal surface

a)

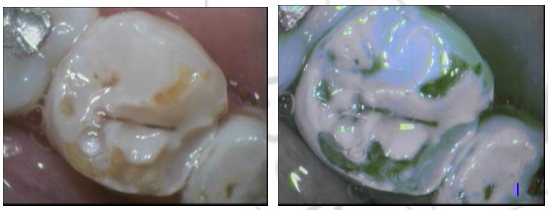


b)

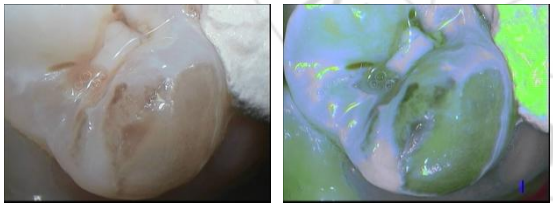


Fluorotic teeth: occlusal surface, cusps and approximal wall

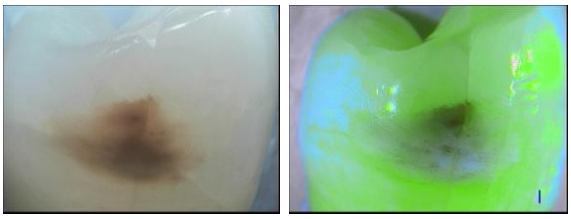
c)



d)



e)



5. Discussion

Dental Fluorosis equally affects male and female subjects, white spots are more frequent among females, while moderate and severe forms are more frequent among males (p>0.005). Males compared to females, can be strongly affected of Dental Fluorosis risk factors [12].

Most affected by fluorosis are upper central incisors 21 (1.86) and 11 (1.85), followed from molars I (1.62-1.69). Further, in a decreasing order are molars II (1.54 – 1.71); upper lateral incisors (1.52-1.54), central lower incisors (1.43-1.44); upper and lower premolars (1.24 – 1.38); lower lateral incisors (1.21-1.22) and most rarely affected are the canines (0.88 – 0.99). The teeth of Moldovian patients were affected by Dental fluorosis in different intensity. With the increasing intensity of fluorosis affection, the number of affected teeth increased. In severe cases the signs of Dental fluorosis could be seen on all dental surfaces. In cases of moderate or severe forms of Dental fluorosis all the teeth were affected, including the deciduous dentitions of the patients [1,5,12].

Results in Bulgaria in town Dimitrovgrad showed that 54.52% of all children included in one study (1504 randomly selected children) had Dental fluorosis in different stages. Deciduous teeth were affected by Dental fluorosis less frequently than permanent teeth ($P < 0.001$). In mixed dentition cases 41.41% of children had fluorosis of permanent teeth only, 1.64% had dental fluorosis of deciduous teeth only and 12.50% had both their primary and permanent teeth affected. The proportion of individuals with the lowest degree of severity - 0.5, was the greatest both for the deciduous and permanent teeth. Comparison with the proportions of children with more severe degrees of fluorosis revealed significant differences ($P < 0.001$) [6].

The prevalence of dental fluorosis in the studied populations in Dimitrovgrad in 2004 was **56.99%,** in Plovdiv in 2005--**7.80%,** and in 2008--**23.18%.** The comparison of the studies in Dimitrovgrad and Plovdiv in 2005 showed lower prevalence of dental caries and lower DMFT values in all age groups ($P < 0.001$). In Dimitrovgrad, the prevalence of dental fluorosis was greater than in Plovdiv ($P < 0.001$). The comparison between the studies in Plovdiv in 2005 and 2008 showed an increase in dental fluorosis in 2008 ($P < 0.001$). The prevalence of dental caries was higher in almost all groups, but the differences failed to reach statistical significance ($P < 0.001$). The DMFT index was higher in 2008 ($P < 0.001$) with the exception of few age groups. The higher prevalence of dental fluorosis does not necessarily leads to low prevalence of dental caries and low DMFT values in the specific population [7].

Correct diagnosis is related to the clinical status and paraclinical examination, changes of the structure and color of the surface. In Bulgaria, Dental fluorosis occurrence has been underestimated in the last two decades [2]. Riordan described trends in dental practice that practitioners overestimate the scores of fluorosis [10]. For diagnosing Dental fluorosis different scales can be used: Classification of H. T. Dean, 1942, Classification of Thylstrup-Fejerskov, 1978, Classification of Luckomski from 1947. Modern devises in use as Light – induced fluorescence, SoproLife camera are described by Ta s s e r y [13]. For diagnosis Dental fluorosis SoproLife camera was performed for the first time in Bulgaria by Peycheva and Boteva in an *in vitro* study. The results and the conclusions in this study are in strong relation and in harmony with the ones in our *in vitro* study. DIAGNO dent Classic diagnoses Dental fluorosis as

simple caries lesions; LIF also does not recognizes Dental fluorosis from a caries lesion [9].

6. Conclusions

1) Moderate and severe fluorosis is diagnosed by QLF-DIAGNOdent Classic device, (n = 43) with scores 99 and recognized as dentine caries.
2) Mild fluorosis is diagnosed by DIAGNO dent Classic device, (n = 137) with scores 30-45-56- which indicates dentine caries.
3) DIAGNO dent Classic diagnoses Dental fluorosis as caries lesions.
4) LIF also does not recognize Dental fluorosis from a caries lesion.
5) SoproLife “day light” and “macro image” shows a realistic appearance of all teeth surfaces under magnification x 30-100 and acts as an intraoral camera with high magnification, up to 100 times. Only best clinical knowledge and careful examination can diagnosed Dental Fluorosis.

References

[1] Angelillo IF., et al, Caries and Fluorosis prevalence in communities with different concentrations of fluoride in water, Car Res,1999,33,2,114-122
[2] B o t e v a , E. Pharmacological and toxicological effects of prophylactic and therapeutic agents in and through the oral environment. – Nauka Farmakologiia, 2011, № 2, 42-46 [Article in Bulgarian]
[3] D a c h e v, B. et al. Propedeutics of therapeutic dentistry. – Meditsina i fizkultura, Sofia, 1988, 48-50 [Article in Bulgarian]
[4] F e j e r s k o v, O., A. Richards et P. DenBesten. The effect of fluoride on tooth mineralization. In: O. Fejerskov et al. Fluoride in Dentistry, 2nd Edition, 1996, Munksgaard, Copenhagen, 112-152
[5] Fordyce FM et al., A health risk assessment for fluoride inCentral Europe, Environ Geochem Health, 2007, Apr, 29 (2),83-102
[6] Kukleva MP, et al.,Prevalence of dental fluorosis among 4- to 14-year-old children from the town of Dimitrovgrad (Bulgaria), Folia Med (Plovdiv). 2007;49(1-2):25-31.
[7] Kukleva MP, Kondeva VK, Isheva AV, Rimalovska SI., Comparative study of dental caries and dental fluorosis in populations of different dental fluorosis prevalence, Folia Med (Plovdiv). 2009 Jul-Sep;51(3):45-52
[8] P i t t s , N. Detection, Assessment, Diagnosis and Monitoring of Caries. – Krager, 2009
[9] Peycheva K., E. Boteva, Methods for diagnosing dental fluorosis: Quantitative laser fluorescence and Light induced fluorescence, Acta Medica Bulgarica,XI,2013,1,53-60
[10] R i o r d a n , P. J. Perception of Dental Fluorosis. – J. Dent. Res., 72, 1993, 1268-1274
[11] Rugg-Gunn, A. J. Nutrition and dental health. – Oxford University, 1993, Press. 21, 28-33, 54, 70-72, 80, 339
[12] Spinei Aurelia,I Spinei, Stomatological assistance to children with dental fluorosis in the Republic of Moldova Republic of Moldova – J Med Dent, Sci 57,2010,N1,17-23
[13] Ta s s e r y H., A New concept in Restorative Dentistry: Light-Induced Fluorescence Evaluator for Diagnosis and Treatment: Part1 – Diagnosis and Treatment of initial Occlusal Caries. – J. Contemporary Dental Practice, 10, 2009, № 6, 1-12.
[14] V i e r a , A. et R. Hancock. Limeback H. How does fluoride concentration in the tooth affect apatite crystal size? – J. Dent. Res., 82, 2003, 909-913.
[15] W a i d y a s e k e r a , K. et al. Why does fluorsed dentine show a higher susceptibility for caries: an ultra-morphological explanation. – J. Med. Dent. Sci., 57, 2010, № 1, 17-23.

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