Clinical management of severe fluorosis in an adult

Huma Farid, Farhan Raza Khan

Dental Section, Department of Surgery, Aga Khan University Hospital, Karachi, Sindh, Pakistan

Correspondence to

Dr Huma Farid,
drhumafarid@hotmail.com

SUMMARY

Dental fluorosis is defined as hypomineralisation of enamel resulting from excessive ingestion of fluoride (more than 1 ppm) during tooth development. Mild-to-moderate forms of dental fluorosis are often unnoticed by the patients whereas severe fluorosis presents with dark brown-to-black discolouration of teeth along with enamel pitting and hypoplasia. Such discolouration results in an unpleasing appearance as well as psychological distress to the affected individual. Dental fluorosis can be managed by bleaching, micro/macroabrasion, veneering or crowning. The choice between different treatment options depends on the severity of fluorosis and patients' aesthetic demands. The aim of this case report was to describe the stepwise oral rehabilitation of an adult with severe fluorosis along with multiple carious teeth. After restoration of carious teeth and extraction of unsalvageable teeth, bleaching and full-coverage restorations were used for the management of fluorosis.

BACKGROUND

Dental fluorosis is defined as hypomineralisation of enamel resulting from excessive ingestion of fluoride (more than 1 ppm) during tooth development. In fluorosed enamel, fluoride disturbs mineralisation by decreasing free calcium ion concentrations in the mineralising matrix, indirectly interfering with the proteinases which degrade matrix proteins during the maturation phase of amelogenesis.¹ The resultant retention of matrix proteins and impaired crystal growth accounts for increase porosities occupied by water and subsequent optical and physical changes.² Excessive fluoride can come from fluoride pollution, inhalation of fluoride dust and fumes from aluminium industry, heavily fluoridated water, supplements, excessive consumption of tea (prevalent in Pakistan, India, Sri Lanka, Bangladesh and middle-eastern countries), and unjustified use of fluoridated toothpastes. The severity of fluorosis depends on the duration, frequency and timings of the exposure during tooth development. The appearance of the affected teeth varies from white streaks (mild form) to brown (moderate form) to dark brown or black (severe form) discolouration. Severe fluorosis sometimes presents with enamel surface defects. The classical appearance of fluorosis is characterised by banding following developmental lines of enamel and by substantial symmetry on homologous teeth.³ Most of the patients with mild-or-moderate fluorosis are unaware of their condition.⁴ Only a limited portion of those having severe fluorosis have aesthetic concern and thus seek dental treatment.

The prevalence of dental fluorosis in USA (National Health And Nutrition Examination Survey 1994–2004) among young adults was 41%.⁵ In

Andhra Pradesh⁶ (India) reported prevalence among young adults is 35% while Chhattisgarh⁷ (India) had 8.2% prevalence of dental fluorosis. In 2009, a survey conducted in Lahore⁸ (Pakistan) showed 12% prevalence of dental fluorosis. Dean,⁹ in 1942, proposed Dean's Fluorosis Index that classifies fluorosis on the basis of clinical appearance (table 1).

Thylstrup and Fejerskov¹⁰ gave their classification of fluorotic teeth on the basis of histological features. Other indices described in the literature are the tooth surface fluorosis index¹¹ and fluorosis risk index.¹² Dean's Fluorosis Index is still widely used for classification of fluorotic teeth.¹³

Management of dental fluorosis depends on the severity of the condition as well as patients' motivation regarding treatment. Different treatment options available for fluorosis are:

1. Micro/macroabrasion
2. Bleaching
3. Composite restorations
4. Veneers
5. Full crowns

CASE PRESENTATION

A 28-year-old gentleman presented to the operative dentistry clinic of Aga Khan University Hospital, Karachi with complaints of severe discolouration of anterior teeth. He was born on a full-term pregnancy in a village near Hyderabad, Pakistan (an area with known high-fluoride content in the underground wells). According to the patient, his discolouration was there since childhood in both primary and permanent dentition. His siblings had similar discolouration too, but to a lesser extent. His medical history was non-contributory. Neither allergy to medicine or foods nor addiction to drugs or smoking was reported by the patient. According to the patient, he was teased by his friends and colleagues for teeth discolouration and they associated this discolouration with smoking or use of chewable tobacco. On clinical examination, there was a

Table 1 Dean's fluorosis index

Classification	Criteria—description of enamel
Normal	Smooth, glossy, pale creamy-white translucent surface
Questionable	A few white flecks or white spots
Very mild	Small opaque, paper white areas covering less than 25% of the tooth surface
Mild	Opaque white areas covering less than 50% of the tooth surface
Moderate	All tooth surfaces affected; marked wear on biting surfaces; brown stain may be present
Severe	All tooth surfaces affected; discrete or confluent pitting; brown stain present

To cite: Farid H, Khan FR. *BMJ Case Reports* Published online: 10 December 2012
doi:10.1136/bcr-2012-007138

Pre-operative Intra – Oral photographs and OPG X-ray

Figure 1 Preoperative intraoral photographs and Orthopantomograph (OPG).

generalised dark brown discolouration with enamel pitting. A diastema was present between maxillary central incisors and between left central and lateral incisor. Beside these findings, there were multiple carious teeth and broken-down roots. (figure 1). On the basis of history and clinical presentation, a diagnosis of ‘generalised severe fluorosis’ was suspected.

DIFFERENTIAL DIAGNOSIS AND INVESTIGATIONS

Dental fluorosis is identified mainly on the basis of its typical clinical appearance, that is, hypoplastic teeth with pitted enamel surface, symmetrical distribution and a history of consuming fluoride-rich water during childhood. Fluorosis is often confused with hypomaturational type of amelogenesis imperfect, enamel hypoplasia and tetracycline staining. Dental fluorosis is difficult to distinguish clinically and histologically from other type of hypoplastic and hypomineralised enamel.¹⁴ Mainly, its patient history of being the resident of an area that is rich in fluoride in water supply and dental expert’s clinical judgment. However, cases that are far from classical may need confirmation using the following techniques:

- ▶ Drinking water fluoride content
- ▶ Quantitative measurement of fluoride intake from other sources like toothpaste, fluoride gels, tea

- ▶ Serum fluoride levels
- ▶ Urine fluoride levels
- ▶ Imbalance in serum electrolytes (calcium, phosphorus, sodium)
- ▶ Diffuse osteosclerosis of skeletal bones revealed through imaging techniques (skeletal fluorosis)
- ▶ Histological analysis of hard tissue

Other than high serum and urine fluoride, laboratory investigations vary for other electrolytes level. Radiographical appearances also show great variability for skeleton fluorosis.

TREATMENT

Although the patient’s primary concern was discolouration of anterior teeth but owing to his neglected oral hygiene, it was planned to undertake restorative aspects first. His treatment was divided into the following three phases:

Phase I

1. Restoration of all carious teeth by fillings instead of filling and root canal treatments where indicated
2. Extraction of broken-down roots and non-restorable teeth

Phase II

Home-based bleaching for 3 weeks (in vacuum form stents)

Post Restorative and bleaching intra-oral pictures and OPG x-ray

Figure 2 Postrestorative and bleaching intraoral pictures and Orthopantomograph (OPG).

Postoperative images of Porcelain fused to Metal crowns and bridges

Figure 3 Postoperative images of porcelain fused to metal crowns and bridges.

Phase III

1. Full-coverage crowns and bridges in endodontically treated teeth
2. Veneers or full-coverage restorations in anterior teeth

Complete treatment plan was discussed with patient and after his understanding and informed consent, treatment was initiated.

Phase I

After educating the patient about his condition and oral hygiene, intraoral photographs and impressions were taken. Restorations of teeth #17, 16, 27, 37 and 46 with amalgam was done. This was followed by extraction of teeth #18, 15, 26 and 35. Root canal treatments of teeth # 14, 24, 25, 36, 45 and 47 was done. Post and core was placed in tooth # 25 owing to insufficient tooth structure.

Phase II

The patient was kept on a follow-up for 1 month before any further treatment. Patient co-operation was very promising; he completely followed the oral hygiene instructions. In phase II, upper and lower vacuum formed bleaching trays were provided to him for 22% carbamide peroxide (Pola Night SDI, Victoria, Australia). He was advised to wear the bleaching trays with bleaching gel overnight for 3 weeks followed by rinsing with water and brushing with desensitising toothpaste (Sensodyne, Glaxo SmithKline, Karachi, Pakistan). However, no sensitivity was reported by the patient. After 3 weeks, a significant change in his teeth shade was observed. Intraoral photographs and an orthopantomograph were again taken. The patient was satisfied to a great extent with the aesthetic results (figure 2).

Phase III

In phase III, fixed prosthesis was provided to the patient in the form of posterior crowns and bridges and upper anterior crowns. Porcelain fused to metal restorations were luted with glass ionomer cement. No treatment other than bleaching and composite filling on incisal edges were provided for lower anterior teeth as they were concealed by lower lip and upper teeth during rest and speech. Also, had we planned an operative procedure, there was an increased risk of pulp involvement owing to their smaller size. Face bow transfer records and semiadjustable articulator was used for the fixed prosthodontics. There was no loss of vertical dimension and the patient had stable occlusion, so a confirmative approach of occlusion was used (figure 3). In the final step, a hard acrylic stabilisation splint (Michigan splint) was provided to the patient for wearing at night for a couple of weeks.

OUTCOME AND FOLLOW-UP

The patient was followed after each phase for his compliance regarding oral hygiene instructions as well as for outcome of each phase (figure 4). After phase III, the patient was followed at 1 and 2 month intervals. There were no complaints of pain or sensitivity. The patient adhered to the oral hygiene instructions provided to him.

DISCUSSION

Teeth discolouration due to fluorosis is an aesthetic concern for certain patients. Treatment depends upon the severity of condition as well as patient's aesthetic demands. A range of restorative treatment options are available. Bleaching alone or in combination with micro/macro abrasion is the most conservative approach for mild-and-moderate fluorosis.^{2 4 15} Although bleaching and abrasion give dramatic improvement in teeth shade and overall aesthetics, however they cannot be considered as an ultimate solution for severe as well as some cases of moderate fluorosis. In these conditions, either veneers or full-

A. Pre – operative

B. After bleaching

C. Post – crowns and bridges workup

Figure 4 (A) Preoperative. (B) After bleaching. (C) Postcrowns and bridges work-up.

coverage crowns are needed to satisfy the patient's aesthetic demands. In this case report, we carried out bleaching after completion of phase I. Bleaching is considered as the least invasive option, but it is also associated with sensitivity in some cases.¹⁵ Micro and macroabrasion, another option for mild-to-moderate fluorosis is a faster procedure but it employs use of high-speed hand piece. If proper coolants are not used or if the operator is not skilled, it can even result in damage to the tooth structure. Another option for moderate and severe fluorosis is Veneers (direct or indirect). Indirect porcelain veneers give better aesthetics, colour stability and wear-resistance as compared with direct composite veneers.¹⁶

In addition to the above-mentioned options, full-coverage restorations are another choice for moderate-to-severe discoloration and surface pitting.¹³ Full coverage restoration requires very careful planning as well as execution of the procedure. Preoperative impressions, occlusal records, face-bow transfer are important when planning for extensive full-coverage restorations. Major advantages of these restorations are desired aesthetic results along with functional rehabilitation if needed. Change in occlusal vertical dimensions can also be accomplished with these restorations. However, at the same time, this option involves time, cost, a skilled dentist as well as good laboratory support.

In the literature, there are case reports discussing management of mild-and-moderate forms of fluorosis and localised severe fluorosis through use of bleaching and abrasion. However, we found few case reports that described the management of generalised severe fluorosis.^{13–17} The present case is an example of stepwise full-mouth rehabilitation utilising different restorative approaches to get an aesthetically, as well as functionally, acceptable outcome.

Learning points

- ▶ Fluoride has a protective role against dental caries, but at the same time, excessive ingestion of fluoride, during tooth development, leads to dental fluorosis.
- ▶ Unsightly appearance due to severe fluorosis may result in psychological distress and social embarrassment for patients.
- ▶ Patient compliance and co-operation is an important aspect of aesthetic rehabilitation of dental fluorosis.

Competing interests None.

Patient consent Obtained.

REFERENCES

- 1 Aoba T, Fejerskov O. Dental fluorosis: chemistry and biology. *Crit Rev Oral Biol Med* 2002;13:155–70.
- 2 Ng F, Manton DJ. Aesthetic management of severely fluorosed incisors in an adolescent female. *Aust Dent J* 2007;52:243–8.
- 3 Levy SM. An update on fluorides and fluorosis. *J Can Dent Assoc* 2003;69:28691.
- 4 Strassler EH, Griffin A, Maggio M. Management of fluorosis using macro and microabrasion. *Dent Today* 2011;30:91–6.
- 5 Beltrán-Aguilar ED, Barker L, Dye BA. *Prevalence and severity of dental fluorosis in the United States, 1999–2004. NCHS data brief, no 53.* Hyattsville: National Center for Health Statistics, 2010.
- 6 Sudhir KM, Prashant GM, Reddy Subba VV, et al. Prevalence and severity of dental fluorosis among 13- to 15-year-old school children of an area known for endemic fluorosis: Nalgonda district of Andhra Pradesh. *J Indian Soc Pedod Prev Dent* 2009;27:190–6.
- 7 Pandey A. Prevalence of fluorosis in an endemic village in central India. *Trop Doct* 2010;40:217–19.
- 8 Rizwan S, Rizwan M, Naveed A, et al. Incidence of dental fluorosis among the patients visiting the university of Lahore dental college/ Hospital—a study. *Pak Oral Dent J* 2010;30:224–8.
- 9 Dean HT. Classification of mottled enamel diagnosis. *J Am Dent Assoc* 1934;21:1421–6.
- 10 Thystrup A, Fejerskov O. Clinical appearance of dental fluorosis in permanent teeth in relation to histologic changes. *Community Dent Oral Epidemiol* 1978;6:315–28.
- 11 Horowitz HS, Driscoll WS, Meyers RJ, et al. A new method for assessing the prevalence of dental fluorosis—the Tooth Surface Index of Fluorosis. *J Am Dent Assoc* 1984;109:37–41.
- 12 Pendrys DG. The fluorosis risk index: a method for investigating risk factors. *J Public Health Dent* 1990;50:291–8.
- 13 Sherwood IA. Fluorosis varied treatment options. *J Conserv Dent* 2010;13:47–53.
- 14 Watts A, Addy M. Tooth discoloration and staining: a review of literature. *Br Dent J* 2001;190:309–16.
- 15 Greenwall L. *Bleaching techniques in restorative dentistry. an illustrated guide.* New York: Martin Dunitz, 2001:244–50.
- 16 Roberson Heymann, Swift. *Sturdevant's art and science of operative dentistry. additional conservative esthetic procedures.* 4th edn. Missouri: Mosby, 2002:610–20.
- 17 Rodd HD, Davidson LE. The aesthetic management of severe dental fluorosis in the young patient. *Dent Update* 1997;24:408–11.

Copyright 2012 BMJ Publishing Group. All rights reserved. For permission to reuse any of this content visit <http://group.bmj.com/group/rights-licensing/permissions>.
BMJ Case Report Fellows may re-use this article for personal use and teaching without any further permission.

Become a Fellow of BMJ Case Reports today and you can:

- ▶ Submit as many cases as you like
- ▶ Enjoy fast sympathetic peer review and rapid publication of accepted articles
- ▶ Access all the published articles
- ▶ Re-use any of the published material for personal use and teaching without further permission

For information on Institutional Fellowships contact consortiasales@bmjgroup.com

Visit casereports.bmj.com for more articles like this and to become a Fellow