Orthodontic Bracket Bonding Challenge for Fluorosed Teeth
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Introduction
Tooth discoloration may be classified as intrinsic, extrinsic, and a combination of both. Intrinsic discoloration occurs following a change to the structural composition or thickness of the dental hard tissues. Extrinsic tooth discoloration is caused by aging, microcracks in the enamel, tetracycline medication, restoration, dental caries, and excessive fluoride ingestion. Excessive fluoride intake in drinking water, >1-2 ppm, can cause metabolic alteration in the ameloblasts, resulting in a defective matrix and improper calcification of teeth.

Diagnosis of dental fluorosis
The adequate diagnosis of fluorosis requires inspection of dry and clean dental surfaces, under a good light source. A fluorosed tooth shows a hypomineralized, porous subsurface enamel, and acid-resistant well-mineralized surface layer Chalky white appearance. Fluorosis can be prevented by having an adequate knowledge of the fluoride sources, knowing how to manage this issue and therefore, avoid overexposure.1-3

Many parts of India are endemic for fluorosis. Nalgonda district of Andhra Pradesh is one such area, where the concentration of fluoride in the drinking water ranges from 1.5 to 5 ppm in some regions to as high as 31.3 ppm in others.4,5

Bonding of orthodontic brackets to fluorosed enamel
It has been emphasized that the most challenging for orthodontists is bonding brackets to fluorosed teeth because of frequent bracket failure at the compromised enamel interface.6 The fluorosed enamel surface challenges orthodontists even more than bonding brackets to gold, amalgam, and porcelain.7 To get an effective bonding clue for this pretty good quantum of patients who pose a great challenge in orthodontics, in terms of poor bond strength of adhesives due to repeated bond failures while using “standard etching protocol,” resulting in a poor treatment outcome. The current orthodontic literature hints that among the various orthodontic adhesive materials, self-etching primer has so far played a promising role in these cases, as is evident from various studies.8

Adhesive procedures require properly integrating multiple interrelated steps in the restorative process, increasing the...
Fluorosed enamel demonstrates an outer hypermineralized and acid-resistant layer, where it is difficult to bond brackets because a reliable etched enamel surface cannot be produced.\textsuperscript{10,11} Dental fluorosis can also influence shear bond strength (SBS) of the orthodontic brackets. \textsuperscript{12-14} Repeated bracket bonding is time-consuming and has a negative effect on successful orthodontic treatment. Some investigators have recommended enamel microabrasion with aluminum oxide powder to fluorosed enamel to remove the acid-resistant hypermineralized surface layer and increase orthodontic bracket bonding efficiency.\textsuperscript{15-17}

Recently, ultra-short pulsed lasers have been used to prepare teeth before orthodontic bonding procedures. These lasers can be focused on the tooth surface with exceptional precision and reproducibility resulting in the ablation of thin layers of enamel without much damage to the adjacent enamel or causing vibration or heating.\textsuperscript{18}

\textit{Enamel microabrasion technique}

Microabrasion technique involves the removal of a small amount of surface enamel with abrasion powder with a dental instrument, Microetcher II (Figure 1). Microabrasion is indicated for fluorosed teeth before bracket bonding, post-orthodontic demineralization, localized hypoplasia due to infection or trauma, and idiopathic hypoplasia where the discoloration is limited to the outer enamel layer.\textsuperscript{7}

\textbf{Clinical case report}

A healthy 17-year-old female patient presented for orthodontic consultation with chief complaint of the gap between teeth, protrusion and difficulty sealing her lip. There was no contributing medical or dental history. Patient oral hygiene was good and temporomandibular function was within normal limits. The initial clinical examination revealed moderate spacing in the upper arch and congenital missing right maxillary canine with mild crowding in the lower arch associated with generalize fluorosis in both upper and lower arch (Figures 2 and 3).

\textbf{Diagnosis and treatment plan}

A facial analysis revealed convex profile with bimaxillary incisor protrusion. A lateral cephalogram revealed a mild skeletal Class I with horizontal growth pattern. Dental Class I malocclusion with spacing in upper arch associated with 4 mm of overjet and overbite and maxillary right canine was congenitally missing.

Fixed orthodontic treatment was planned in the patient to close the spacing in maxillary arch and alignment in the mandibular arch using MBT 0.002” Pre-adjusted edgewise appliance. The additional step of microabrasion/microetching was done before routine etching of enamel before bonding of orthodontic appliance using Microetcher II (intraoral microabrasion using 50 \( \mu \)m of aluminum oxide).

The following microabrasion protocol was done: All teeth were polished with pumice and water slurry. Teeth isolation was done with a rubber dam (Figure 4a), and microabrasion was performed using microabraded with 50 \( \mu \)m of aluminum silicate for 5 s (Figure 4b). 37\% phosphoric acid etchant were then placed on the air-abraded enamel surface with a syringe applicator for 30 s. The etchant was thoroughly washed with water for 10 s followed by air-drying for 10 s.

\begin{figure}[h]
\centering
\includegraphics[width=\textwidth]{image1.png}
\caption{Microabrasion dental instrument, Microetcher II.}
\end{figure}

\begin{figure}[h]
\centering
\includegraphics[width=\textwidth]{image2.png}
\caption{Pre-treatment extra-oral photos showing incompetent lip seal and convex profile. (a) Front photo at rest, (b) front photo on smile, (c) profile view.}
\end{figure}
An adhesion promoter Primer (3M Unitek) was applied and gently air dried for 5 s, followed by light curing for 10 s with a visible white light unit. 3M Unitek Transbond XT adhesive placed on the base of the bracket and light cured for 60 s.

The patient was initiated with 0.016” Nitinol archwire for alignment (Figure 5). After alignment, final leveling and finishing of the case was done with 0.019 x 0.025” stainless steel archwire (Figure 6). Interproximal slicing was done to align mandibular teeth. It was found that during orthodontic treatment patient never came with debonded brackets and also acceptable treatment result was achieved. Care was taken to maintain space for prosthetic replacement of right maxillary canine.

**Treatment results**

The main request of the patient was to close space and reduce protrusion, improve sealing of her lips and balance her profile. The final result showed good alignment, occlusion, ideal overbite and overjet and the patient is happy with the orthodontic treatment results (Figures 7 and 8), and cephalometric analysis suggesting acceptable dental inclination and soft tissue profile achieved (Table 1).

**Discussion**

Dental fluorosis is not only a major esthetic concern but also highly challenging and expensive condition to treat. If left untreated, it can cause embarrassment for the school-aged children, resulting in psychosocial distress, difficulties in societal adjustment, and damage to the self-esteem of the patient. They are teased by their peers, usually adopt avoidance behavior when to meet others, put hand before his mouth while smiling. They lack initiative due to compromised confidence level.2,3,7

It is well known that normal fluoride level is an important dietary supplement, which has been proven effective in preventing dental caries. It is, however, the excessive fluoride which damages ameloblasts as was evident from the present study sample. Crippling of these cells jeopardizes not only the mineralization process of the teeth but also increases the porosity of the sub-surface of enamel. Thus, dental fluorosis in its more advanced stages can leave teeth more susceptible to increased caries lesions because of pitting and loss of the outer enamel.19

As stated earlier, the long term over-intake of fluoride may cause skeletal as well as dental fluorosis. Many studies on other toxic effects of fluoride have been made and including whether it alters the human genetic material and ultimately leads to more serious harm.20

**Conclusions**

Microabrasion promotion heralds new and improved options for orthodontists when dealing with the clinical dilemma of bonding to fluorosed and hypocalcified enamel. The results of this case report have provided encouraging clinical evidence of bonding to fluorosed teeth.

Use of microabrasion method increases micromechanical orthodontic bracket retention of severely fluorosed human teeth and provides a clinically successful adhesive bonding protocol.

Public awareness campaign both at School, Masjid and Community level is to be mobilized. Children and adults inflicted with fluorosis and should be given treatment priority,
so as to minimize or disguise their staining stigma and pitting abnormalities of the teeth. Restoring their smiles through dental esthetics will help them in gaining self-esteem and confidence level.
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References