Macroabrasion in Pediatric Dentistry

Deepti Amarlal*/ Rayen R **/ M.S Muthu ***

One of the most frequent reasons for seeking dental care is discolored anterior teeth. Macroabrasion is a technique used for the removal of localized superficial white spots and other surface stains. This article has compiled three case reports with relevant clinical photographs of discolored teeth where the treatment regimen included macroabrasion alone as well as macro-abrasion in combination with anterior composite restorations.
J Clin Pediatr Dent 31(1):9-13, 2006

INTRODUCTION

One of the most frequent reasons for seeking dental care is discolored anterior teeth. The color of a child's teeth is of great importance. In the existing society, peer group influence plays a major role in the child's mind. A comment about their discolored teeth can prove to be harmful to a child. A critical factor in the esthetic alterations of discolored anterior teeth is its correlation with some psychological aspects in children and adolescents.[1] Judd PL and Casas MJ (1995)[2] stated, "The appearance of a disfigured smile negatively affects the psycho-emotional development of children, increasing their problems with social relations." Slack GL and Jones JM (1955)[3] observed that the progress of children in school and their behavior elsewhere, as well as their psychologic well being, can be adversely influenced by an injury or unsightly appearance of the teeth.

The causes of discolored teeth may be classified in a number of ways: Congenital/acquired; affecting enamel/dentin; extrinsic/intrinsic; systemic/local. The most useful method of classification for the clinical management of discoloration is the one that identifies the main site of discoloration.[4]

Etiology of tooth discoloration:[4]
I. Extrinsic staining:
1. Beverages/food
2. Smoking
3. Poor oral hygiene- Chromogenic bacteria- Green/Orange stain
4. Drugs
Iron supplements – Black stain
Minocycline – Black stain
Chlorhexidine- Brown/Black stain

II. Intrinsic staining

Enamel	
Local causes	Caries
	Idiopathic
	Injury/Infection
	Internal resorption
Systemic causes	Amelogenesis imperfecta
	Drugs eg. tetracyclines
	Fluorosis
	Idiopathic
	Systemic illness during tooth formation
Dentin	
Local causes	Caries
	Internal resorption
	Metallic restorative materials
	Necrotic pulp tissue
	Root canal filling materials
Systemic causes	Bilirubin
	Congenital porphyria
	Dentinogenesis imperfecta
	Drugs eg. tetracyclines

Several methods are used for the treatment of discolored teeth. Some of the advanced restorative techniques are:
1. Macroabrasion
2. Hydrochloric acid- pumice microabrasion

*Deepti Amarlal: Postgraduate student Department of Pedodontics and Preventive Dentistry, Meenakshi Ammal Dental College & Hospital
** Rayen R: Lecturer Department of Pedodontics and Preventive Dentistry, Meenakshi Ammal Dental College & Hospital
*** M.S Muthu Associate Professor and Head,Department of Pedodontics and Preventive Dentistry, Meenakshi Ammal Dental College & Hospital

All correspondence should be sent to: Dr. M.S Muthu MDS., Department of Pedodontics and Preventive Dentistry, Meenakshi Ammal Dental College & Hospital,
Alapakkam main road, Maduravoyl,Chennai-600095. Tamil nadu.India.

Phone no. +91-44-9444045094
Fax no. +91-44-23781631
E-mail id. muthumurugan@rediffmail.com

3. Non-vital bleaching
4. Vital bleaching-chairside and nightguard
5. Localized composite restorations
6. Composite veneers-direct and indirect
7. Porcelain veneers
8. Adhesive metal castings
9. Full crowns
10. Bridgework-adhesive and fixed

In the past years, all-ceramic and porcelain-fused-to-metal crowns were often the treatment of choice for patients with damaged or stained teeth (Shillingburg *et al* 1997).[5] Since the early 1980's bonded ceramic veneer restorations have been employed (Calamia JR 1983).[6] In late 1980's, even more conservative methods have become available for treatment of discolored teeth. Macroabrasion, microabrasion and tooth bleaching represent a minimally noninvasive step in achieving acceptable results in the removal of enamel stains and minor surface defects.

Roberson *et al* (2002)[7] described microabrasion and macroabrasion as conservative alternatives for the reduction or elimination of superficial discolorations. As the terms apply, the stained areas or defects are abraded away. These techniques do result in the physical removal of tooth structure and therefore they are indicated only for stains or enamel defects that do not extend beyond a few tenths of a millimeter in depth.

Macroabrasion is a technique used for the removal of localized superficial white spots and other surface stains.[7] Heymann HO *et al* (1995)[7] has defined macroabrasion as the removal of surface defects with handpiece instrumentation such as those surface stains found with dental fluorosis. When not completely successful, these methods are very effective in improving the tooth "canvas", so that restorative treatment achieves optimal result.[8] When there is loss of tooth structure associated with the defects, the use of composite resins produces excellent esthetic results and stable clinical longevity.[9]

This article describes three case reports with discolored teeth where the treatment regimen included both macrabrasion, and macroabrasion in combination with anterior composite restoration.

CASE REPORTS

Case 1: A 11-year old boy presented to the Department of Pedodontics, Meenakshi Ammal Dental College and Hospital, Chennai with the chief complaint of discolored upper front two teeth (Fig 1). The patient reported living in an area where the fluoride content of water was high. Clinically the patient had brown-white fluorosis stains affecting the maxillary permanent central and lateral incisors and the canines. The brown stains were noted in 1.0-2.0 mm wide bands extending from the middle third to the incisal third of the two permanent maxillary central incisors. Minor stains were present on the laterals and canines. The brown stains were consistent with the moderate category of Dean's index[10] and the white opacities were consistent with level 3 of the Thylstrup-Fejerskov index.[11] The restorative procedure alternatives were explained to the patient, including the different costs, the levels of tooth structure removal, the expected clinical longevity and the possible esthetic result. Treatment goal was to remove the brown stains in a conservative and affordable way, which still allows for the more aggressive treatment options to be employed later. Preoperative photographs were taken for comparison after the treatment.

Figure 1: Preoperative image of case 1 depicting brown fluorosis stains on the permanent maxillary central incisors and to a lesser extent on the lateral incisors and canines.

Macroabrasion was done to remove the brown fluorosis stains. Composite finishing bur (TR-11EF, Prime dental products) of diameter 20-30m was used in high speed handpiece with water cooling. Water was used to prevent desiccation of the teeth. During this treatment, the prominent brown stains were removed but the discoloration was still present. Hence a composite restoration was planned. An opaquer (3M ESPE) was first used to mask the discoloration following which an A2.5 shade (3M ESPE) composite material. The regular routine of acid etching and bonding agent application was followed. To restore the surface smoothness and luster, a series of flexible disks (Sof-Lex, 3M ESPE) were used. The patient was extremely satisfied with the results (Fig 2).

Figure 2: Postoperative image of the same patient with macroabrasion and composite restoration done in the permanent maxillary central incisors.

Case 2: A 10-year old girl presented to the department with the similar complaint and a similar history as the above mentioned case (Fig 3). Clinically the patient had brown-white fluorosis stains affecting the maxillary permanent central incisors and to a smaller extent on the lateral incisors. The brown stains were noted as two bands on the permanent maxillary central incisors. One band of width 0.5-1 mm was present at the junction of the cervical and the middle third and the second band of width 1-2mm was present on the incisal third. Minor brown stains were present on the lateral incisors and frost

Figure 3: Pretreatment view of case 2 revealing two bands of brown fluorosis stains present on the permanent maxillary central incisors.

white areas were present on the rest of the teeth. The brown stains were consistent with the moderate category of Dean's index[10] and the white opacities were consistent with level 3 of the Thlystrup-Fejerskov index.[11]

The treatment planning was similar to the previous case. Macroabrasion was carried out for the permanent central and lateral incisors as described above. As satisfactory results were obtained, no further restorative treatment was planned. After finishing and polishing, fluoride varnish (Bifluorid 12; Voco chemi GmbH, Cuxhaven, Germany) was applied to all the teeth. Patient did not report any sensitivity or discoloration after a follow up period of 24 hours and after 3 months and was satisfied with the results (Fig 4).

Figure 4: Post-treatment view of the same patient after macroabrasion.

Case 3: A 10-year-old boy presented to the department with similar complaints and similar history as the above mentioned cases (Fig 5). Clinically the patient had brown-white fluorosis stains affecting the maxillary permanent central incisors and to a lesser extent on the lateral incisors and mandibular incisors. The brown stains were noted in 1.0-2.0 mm wide bands extending from the middle third to the incisal third of the two permanent maxillary central incisors. Minor brown stains were present on the lateral incisors and mandibular incisors and frost white areas were present on the rest of the teeth. The brown stains were consistent with the moderate category of

Figure 5: Photograph of case 3 depicting brown stains on the permanent maxillary central incisors and to a lesser extent on the lateral incisors.

Figure 6: Postoperative photograph of the same patient showing the incisors after macroabrasion.

Deans flourosis index[10] and the white opacities were consistent with level 3 of the Thlystrup-Fejerskov index.[11] The treatment planning was similar to the previous case. Macroabrasion was carried out for the permanent central and lateral incisors as described above. As satisfactory results were obtained, no further restorative treatment was planned. After finishing and polishing, fluoride varnish (Bifluorid 12; Voco chemi GmbH, Cuxhaven, Germany) was applied to all the teeth. Patient did not report any sensitivity or discoloration after a follow up of 24 hours and after a period of 3 months and was satisfied with the results (Fig 6).

DISCUSSION

Conservative treatments like bleaching, microabrasion and macroabrasion offer advantages over more conventional treatments involving partial or complete coverage restorations. According to Christensen GJ (1989),[12] some of the conventional restorative treatments have caused gingivitis, periodontitis, endodontic needs, and extreme wear of opposing teeth.

Porcelain veneers may be the most satisfactory long term restoration for a severely hypoplastic or discolored tooth, but it is not an appropriate solution for children for two reasons 1) the large size of the young pulp horns and chamber 2) the immature gingival contour.[4] According to Welbury RR (2001),[4] composite veneers are

durable enough to last through adolescence until a more esthetic porcelain veneer can be placed. This is normally considered only at about the age of 20 years when the gingival margin has achieved an adult level and the standard of oral hygiene and dental motivation are acceptable.

In our case reports, all the patients were below 16 years of age. Hence, more conservative treatments were planned initially and the options of veneers were explained to the patients.

Bleaching is a conservative technique, which involves the lightening of the color of a tooth through the application of a chemical agent to oxidize the organic pigmentation in the tooth. According to Roberson TM, Heymann HO and Swift EJ (2002)[7] disadvantages of bleaching are that it is a lengthy and time consuming procedure that requires a high degree of patient compliance and motivation. The features that warrant concern and caution include soft tissue damage to patient and provider, the discomfort of a rubber dam, and the potential for post treatment sensitivity. According to Goldstein *et al* (1989)[13], when vital teeth are bleached, direct contact is established between the bleaching agent and the outer enamel surface. Potential damage to the pulp is the primary concern with the bleaching agents and the heat used to activate the bleaching agents. According to Croll TP and Cavanaugh RR (1986)[14], the method used can be dangerous to the patient, the dentist, the dental assistant, if the practitioner does not have control of the bleaching agent and a full understanding of the treatment rationale.

Microabrasion is an effective alternative for conservative management of discolored teeth. The technique described by Mc Closey in 1984[15], involves the use of hydrochloric acid swabbed on the teeth for the removal of superficial fluorosis stains. Subsequently, in 1986 Croll[16] modified the technique to include the use of pumice with hydrochloric acid to form a paste. An important concern about the safety of the hydrochloric acid- pumice abrasion according to Croll (1989)[17] is the low viscosity and high concentration of the 18% hydrochloric acid. Hence, Samze Erdogan (2003)[18] used a modified microabrasion technique wherein he used quartz particles to the hydrochloric acid – pumice mixture to increase the viscosity and safety of 18% hydrochloric acid. In 1989, Kendell[19] reported that a 5-second application of a hydrochloric acid – pumice mixture removes 46mm of enamel and suggested that removal of that amount of enamel in the middle to the incisal thirds of the crown should be comfortably tolerated.

According to Welbury RR3, microabrasion is more effective in removing brown mottling when compared to frost white areas. Croll (1995)[20] suggested that enamel microabrasion should not be attempted for patients with tooth discoloration from dentin discoloration, such as with tetracycline staining or dentinogenesis imperfecta. Croll TP and Cavanaugh RR (1986)[14] stated that a carefully sealed rubber dam and patient protection with eyeglasses is essential for the procedure.

Bodden MK and Haywood VB (2003)[8] described the successful treatment of a patient with dental fluorosis on a background of tetracycline staining. The regimen involved a combination of macroabrasion and night guard vital bleaching. The authors also evaluated several instrumentation options of macroabrasion. Three instrument combinations were devised:

1. Diamond bur and two grades of diamond polishing paste
2. Diamond bur, flexible disks and enhance polishers (Dentsply)
3. Carbide bur and flexible disks

The combination of long –bladed carbide burs and a series of flexible disks produced the best results. The long burs effectively removed the frost-white enamel affected by fluorosis and maintained the natural line angles and tooth contour. The enamel "shaving" action of the carbide blades also left a relatively smooth surface. The series of coarse, medium, fine and superfine flexible disks were then used to produce the desired surface smoothness and luster.
In our cases both microabrasion and macroabrasion were considered to remove the stains. However microabrasion was ruled out because of the time and materials required for treatment.

Advantages of Macroabrasion

1. This technique is considerably faster and does not require rubber dam or any other special instruments.
2. Defect removal is easier with macroabrasion when compared with microabrasion if an air water spray is used during treatment to maintain hydration of teeth.
3. Diamond and carbide burs can be effectively used to remove the superficial and microabrasion resistant frost white stains while preserving adjacent sound tooth structure.
4. Use of long-bladed carbide burs also maintained the tooth contours and line angles, so that their apparent width and shapes remained constant.

Disadvantages of Macroabrasion

1. Microabrasion when compared to macroabrasion has the advantage of ensuring better control of the removal of tooth structure.
2. High-speed instrumentation as used in macroabrasion is technique sensitive and can have catastrophic results if extreme caution is not exercised.

The main objective of the treatment was to provide best possible results with minimal discomfort to the patient. With elimination of rubber dam and other safety concerns for the patient as well as the dentist, the level of discomfort was minimized. Patient and parent satisfaction was the best result we achieved with this treatment plan. The eagerness of the patients to go to school and show off their bright new smiles to their friends was the ultimate goal achieved. As rightly put by Anon, "No jewel in the world can match the radiance of joy reflected in a happy smiling face."

REFERENCES

1. Koroluk LD, Riekman GA. Parental perceptions of the effects of max illary incisor extractions in children with nursing caries. J Dent Child 58:233 – 236,1991.
2. Judd PL, Casas MJ. Psychosocial perceptions of premature tooth loss in children. Ont Dent 72:22 – 26,1995.
3. Slack GL, Jones JM. Psychological effect of fractured incisors. Br Dent J 99:386 – 388,1995.
4. Richard R. Welbury. Pediatric Dentistry. 2nd ed. Oxford Medical Publications; 191 – 215,2001.
5. Shillingburg HT, Hobo S, Whitsett LD, Jacobi R, Brackett SE. Fundamentals of fixed Prosthodontics, 3rd ed. Chicago: Quintessence, 1997.
6. Calamia JR. Etched porcelain facial veneers: A new treatment modality based on scientific and clinical evidences. NYJ Dent 53:173 – 176,1989.
7. Theodore M. Roberson, Harald O. Heymann, Edward J. Swift JR. Strudevent's Art and science of Operative dentistry. 4th ed. Mosby publications; 591 – 650,2000.

8. M. Kirby Bodden, Van B. Haywood. Treatment of endemic fluorosis and tetracycline staining with macroabrasion and night guard vital bleaching: A case report. Quintessence Int. 3(2):15 – 18,2003.
9. Soares CJ et al. Esthetic rehabilitation of anterior teeth affected by enamel hypoplasia: A case report. Journal of esthetic and restorative dentistry. 14(6):340 – 348,2002.
10. Ole Fejerskov, Jan Ekstrand, Brian A Burt. Fluorides in Dentistry. 2nd ed. Munksgaard, Copenhagen; 120,1996.
11. Thylstrup A Fejerskov O. Clinical appearance of dental fluorosis in permanent teeth in relation to histological changes. Community Dent Oral Epidemiol. 6:315-328,1978.
12. Christensen GJ. Esthetic dentistry and ethics. Quintessence Int. 20:747 – 753,1989.
13. Goldstein CE, Goldstein RE, Feinman RA, Garber DA. Bleaching vital teeth: State of the art. Quintessence Int. 20:729-739,1989.
14. Croll TP, Cavanaugh RR. Hydrochloric acid – pumice enamel surface abrasion for color modification: Results after six months. Quintessence Int. 17:335 – 338,1986.
15. Croll TP. Enamel microabrasion: The technique. Quintessence Int. 20:395 – 400,1989.
16. Croll TP, Cavanaugh RR. Enamel color modification by controlled hydrochloric acid – pumice surface abrasion. Technique and examples. Quintessence Int. 17:81,1986.
17. Mc Closkey RJ. A technique for removal of fluorosis stains. J Am Dent Assoc. 109:63 – 64,1984.
18. Samze Erdogan. The effectiveness of a modified hydrochloric acid – quartz – pumice abrasion technique on fluorosis stains: A case report. Quintessence Int. 3(6): 23 – 27, 2003.
19. Kendell RL. Hydrochloric acid removal of brown fluorosis stains. Clinical and scanning electron micrographic observations. Quintessence Int. 20:837-839,1989.
20. Croll TP. Enamel microabrasion for removal of superficial demineral ization and decalcification defects. J Am Dent Assoc 120:411 – 415,1995.