

# **TREATMENT OF INTRINSIC DISCOLORATION IN PERMANENT ANTERIOR TEETH IN CHILDREN AND ADOLESCENTS**

Alyson Wray and Richard Welbury.

## **INTRODUCTION**

Intrinsic discoloration can be defined as discoloration which is incorporated into the structure of either enamel or dentine and which cannot be removed by prophylaxis with toothpaste or pumice.

Intrinsic tooth discoloration can be a significant cosmetic, and in some instances, functional, problem. Loss of vitality secondary to trauma or infection frequently results in tooth discoloration which is not responsive to conventional endodontic therapy. Similarly fluorosis, tetracycline staining, localised and chronological hypoplasia, and both amelogenesis and dentinogenesis imperfecta can all produce a cosmetically unsatisfactory dentition and, in the latter two examples a structurally “at risk” dentition as well. These Guidelines are designed to outline the most appropriate options for treating the different aetiological categories of intrinsic discoloration of the anterior permanent dentition in child and adolescent patients. Examples of the main causes of intrinsic discoloration and details of the various techniques are included in “*Explanatory Notes*”.

## **1.0 DIAGNOSIS**

### **1.1 History**

A careful, detailed history is essential for the accurate diagnosis of intrinsic tooth discoloration, as the choice of treatment is greatly influenced by the aetiology. Specifically: details of the mother’s obstetric history and the delivery; medical history including neo-natal or early childhood illness and any drugs taken; dental history including infections relating to primary teeth; trauma to the primary and permanent teeth; family history of discoloured or abnormal teeth; fluoride history including supplementation, residence in natural water fluoridation areas, toothbrushing habits including the amount of paste used, the type of paste in childhood and any admitted swallowing of paste.

### **1.2 Examination**

#### ***1.2.1 Clinical***

A standard extra-oral examination and full mouth intra-oral examination should be undertaken, with special emphasis on the presence and/or absence of both primary and permanent teeth. The distribution of any discoloration or hypoplasia should be clearly established, specifically whether both dentitions are affected or not, whether all teeth in one dentition are equally affected, and whether or not there is a symmetrical or chronological pattern. The features of discoloration may have been evident at tooth eruption, or may have developed subsequently and become either more or less severe in the intervening time. If possible, the extent of discoloration should be identified with respect to the depth of affected enamel or dentine.

### ***1.2.2 Additional Investigations.***

Appropriate radiographs will show abnormalities of enamel and dentine structure, abnormal tooth morphology and the adequacy of root canal fillings in non-vital teeth. Sensibility testing will suggest the presence or absence of a functioning nerve supply, implying an intact vasculature.

Histological sectioning of exfoliated or extracted teeth may identify hereditary and environmental abnormalities.

## **2.0 MANAGEMENT**

>B

The treatment of choice is dependent on the diagnosis. In many cases of discoloration there is a hierarchy of treatment options. These should be pursued in a logical order until a satisfactory cosmetic outcome is achieved. Pre-treatment photographs, shade taking and sensibility tests are recommended in all cases.

### **2.1 Microabrasion**

Microabrasion involves the removal of a small amount of surface enamel and classically incorporates both ‘abrasion’ with dental instruments and ‘erosion’ with an acid mixture. The term ‘abrosion ‘ has been used by some authors.

There are two main techniques for microabrading discoloured or hypoplastic teeth. These are the hydrochloric acid/pumice technique(1-17) which requires very careful isolation of the affected teeth, and the phosphoric acid/pumice technique(18) (see “*Explanatory Notes*”). These techniques are simple to perform and the depth of enamel removed in 10 applications is approximately 100 µm. (0.1 mm.). Microabrasion is indicated for fluorosis, post-orthodontic demineralisation, localised hypoplasia due to infection or trauma, and idiopathic hypoplasia where the discoloration is limited to the outer enamel layer. Analysis of the effectiveness of microabrasion should be delayed for approximately one month post-treatment, as the appearance of the teeth will continue to improve during this time.

### **2.2 Non-Vital Bleaching**

This technique is indicated for non-vital, endodontically treated teeth which have become discoloured due to the deposition of blood degradation products in the dentinal tubules.(19-39) A well condensed root canal filling must be present prior to starting non-vital bleaching. Most techniques utilise hydrogen peroxide or sodium perborate (*Bocasan*) either together or independently. (see “*Explanatory Notes*”). Where a non-vital tooth has an unsatisfactory root canal filling this should be replaced with a well condensed gutta percha restoration prior to undertaking non-vital bleaching.

## **2.3 Vital Bleaching**

### **2.3.1- Chairside**

This technique involves the external application of hydrogen peroxide to the surface of the tooth followed by its activation with a heat source.(40-47) It is indicated for mild tetracycline staining without obvious banding, mild fluorosis, and single teeth with sclerosed pulp chambers and root canals. The results have been found to be variable.

### **2.3.2 Vital Bleaching - Nightguard**

This technique involves the daily placement of carbamide peroxide gel into a customfitted tray of either the upper or lower arch.(47-63) It is carried out by the patient at home and is initially done on a daily basis. The technique is indicated for mild fluorosis, and moderate fluorosis as an adjunct to microabrasion.

## **2.4 Composite Resin Restorations**

The large size of the immature pulp chamber and pulp horns, and the immature gingival contour of the adolescent patient contra-indicates the use of porcelain veneers. Composite resin offers a satisfactory alternative and should be used in child and adolescent patients(64-68). Resin can be used by either to camouflage/replace discrete localised areas of abnormal enamel ( localised composites ) or to cover the entire enamel surface (veneer ).For techniques see “*Explanatory Notes*”.

Composite resin restorations are indicated in cases of hypoplasia caused by moderate to severe fluorosis, localised hypoplasia not responsive to microabrasion, chronological hypoplasia, tetracycline staining, discoloration due to loss of vitality not responsive to non-vital bleaching, amelogenesis and dentinogenesis imperfecta, and idiopathic hypoplasia. Composite veneers can be placed directly on to the tooth surface or fabricated indirectly in the laboratory.

## **2.5 Porcelain Veneers**

Porcelain veneers are indicated for hypoplastic and discoloured teeth in patients aged 16 years and over, when techniques such as microabrasion, non-vital bleaching and composite resins have failed to produce a satisfactory clinical result.(69)

## **EXPLANATORY NOTES**

### **1.1 MAIN CAUSES OF INTRINSIC DISCOLORATION**

#### **1.11 Within Enamel:**

Local: caries; idiopathic; injury/infection of primary predecessor; internal resorption.

Systemic: amelogenesis imperfecta; drugs, eg. Tetracycline; fluorosis; idiopathic; systemic illnesses during tooth formation.

#### **1.12 Within Dentine:**

Local: caries; internal resorption; metallic restorative materials; necrotic pulp tissue; root canal filling materials.

Systemic: bilirubin (haemolytic disease of the newborn); congenital porphyria; dentinogenesis imperfecta; drugs, eg. Tetracycline.

### **1.2 MICROABRASION**

#### **1.2.1 Hydrochloric Acid / Pumice Microabrasion**

Using this technique a maximum of 100  $\mu\text{m}$ . of enamel is removed. If a satisfactory clinical outcome is not achieved the technique should not be repeated but an alternative treatment selected. Pre-operative sensibility tests, radiographs and photographs are advised.

- (i) Clean teeth to be treated with pumice and water, wash and dry.
- (ii) Isolate the teeth to be treated with rubber dam and either apply vaseline to the gingiva prior to rubber dam application or paint Copalite varnish around the necks of the teeth after dam application.
- (iii) Place a mixture of sodium bicarbonate and water on the rubber dam behind the teeth to protect in case of spillage.
- (iv) Mix 18% hydrochloric acid with pumice into a slurry and apply a small amount to the labial surface with either a slowly rotating rubber cup, a wooden stick or flat plastic instrument rubbed over the surface for 5 seconds. Wash for 5 seconds directly into the aspirator. Repeat until the stain is reduced, up to a maximum of 10 x 5 second applications per tooth. Any improvement possible will have occurred by this time.
- (v) Apply fluoride drops to the teeth for 3 minutes.
- (vi) Remove the rubber dam.
- (vii) Polish the teeth with graded Soflex discs or proprietary polishing pastes.
- (viii) Polish the teeth with fluoridated toothpaste for one minute.
- (ix) Review in one month for sensibility testing and photographs.
- (x) Review in six months to check pulpal status.

#### **1.2.2 Phosphoric Acid / Pumice Microabrasion**

- (i) Clean teeth to be treated with pumice and water, wash and dry.
- (ii) Apply phosphoric acid 35% to enamel surface for 30 secs, wash and dry.
- (iii) Remove frosted enamel with tungsten carbide composite finishing bur, running dry in an air turbine using minimal pressure, until a shiny enamel surface reappears.
- (iv) Clean teeth with a further pumice and water slurry in a slowly rotating rubber prophylaxis cup, and then wash again.
- (v) Continue with stages (vii) to (x) as detailed in 1.1.1 above.

### **1.3 NON-VITAL BLEACHING**

*Pre-operative radiographs are essential to ensure adequate root canal obturation has occurred.*

- (i) Clean the teeth with pumice and note the tooth shade.*
- (ii) Place rubber dam isolating the single tooth (or teeth) to be treated. Ensure complete eye protection for the operator assistant and patient.*
- (iii) Remove palatal and pulp chamber restorations.*
- (iv) Remove the root filling to the level of 2mm below the gingival margin; this may require extended burs.*
- (v) Place 1 mm. of glass ionomer or conventional cement over the gutta percha.*
- (v) Remove any stained dentine with a round bur. Avoid excessive removal of tissue.*
- (vi) Etch the pulp chamber with 37% phosphoric acid for 30-60 seconds, wash and dry. This will open the dentinal tubules.*
- (vii) Either mix a thick paste of 35% hydrogen peroxide and sodium perborate (Bocasan), or perborate and water alone, and place immediately into the pulp chamber with an instrument or on a cotton wool pledget.*
- (viii) Place a small piece of dry cotton wool over the mixture.*
- (ix) Seal the cavity with glass ionomer cement.*
- (x) Repeat the process at weekly intervals until the tooth is slightly over bleached.*
- (xi) Place non-setting calcium hydroxide into the pulp chamber and seal with glass ionomer cement. Leave for two weeks. Together with step (iv) it will help to reduce the incidence of external cervical resorption which has been associated with this technique.*
- (xii) Restore the tooth either with white gutta percha in the pulp chamber and appropriately shaded composite resin to the access cavity, or with 'total bonded' incrementally cured composite resin to the pulp chamber and access cavity. The former allows rebleaching, the latter does not.*

## **1.4 VITAL BLEACHING**

### **1.4.1 Vital bleaching – Chairside**

*The technique involves the external application of hydrogen peroxide to the surface of the tooth followed by its activation with a heat source.*

- (i) Pre-operative periapical radiographs and vitality tests. Any leaking restorations should be replaced.*
- (ii) Clean teeth with pumice and water to remove extrinsic staining. Pre-operative photographs should be taken with a tooth from a 'Vita' shade guide registering the shade, adjacent to the patient's teeth.*
- (iii) Apply topical anaesthetic to the gingival margins.*
- (iv) Coat the buccal and palatal gingivae with Vaseline or Orabase gel.*
- (v) Isolate each tooth to be bleached with individual ligatures.*
- (vi) Cover the metal clamps with damp gauze to prevent them overheating under the heat source.*
- (vii) Etch the labial and incisal third of the palatal surface of the tooth with phosphoric acid for 60 secs, wash and dry. Thoroughly soak a strip of gauze in the 35% hydrogen peroxide and cover the teeth to be bleached. Alternatively hydrogen peroxide gel may be accurately applied to the teeth.*
- (viii) Position the heat source (Union Broach Lamp) 13-15 inches from the teeth. Set the rheostat to mid-temperature range and then increase it until the patient can just feel the warmth and then reduce it until no sensation is felt. The gels on the market recommend a standard curing light directed onto individual teeth.*
- (ix) The gauze or the gel will need to be replenished every 3-5 mins.*
- (x) After 30 mins remove the rubber dam, clean off the Orabase or Vaseline and polish the teeth using shofu stones. Apply fluoride drops for 2-3 mins.*

- (xi) *Post-operative sensitivity may require analgesia with paracetamol.*
- (xii) *Assess the change. It may be necessary to do each arch 3-10 times. Treat one arch at a time. Rebleaching may be required after 1 year.*
- (xiii) *Take post-operative photographs with the original 'Vita' shade tooth included.*

#### **1.4.2 Vital bleaching - Nightguard**

*This technique involves the daily placement of carbamide peroxide gel into a custom fitted tray of either the upper or lower arch. As the name suggests it is carried out by the patient at home and is usually done on a daily basis.*

- (i) *Pre-operative photographs with a 'Vita' shade tooth.*
- (ii) *Take an alginate impression of the arch to be treated and cast a working model in stone.*
- (iii) *Relieve the labial surfaces of the teeth to be treated by about 0.5mm, and make a soft blow-down vacuum formed splint as a mouthguard. The splint should be no more than 2mm thick and should not cover the gingivae.*
- (iv) *Instruct the patient on how to floss their teeth thoroughly. Perform a full mouth prophylaxis and instruct them how to apply the gel into the mouthguard.*
- (v) *The length of time the guard should be worn per day will be dependant upon the product and the manufacturers instructions.*
- (vi) *Review the patient regularly to check that they are not experiencing any sensitivity.*
- (vii) *Post-operative photographs with original 'Vita' shade tooth.*

### **1.5 COMPOSITE RESTORATIONS**

#### **1.5.1 Localised Composite Restorations**

*This technique is indicated for well demarcated white, yellow or brown hypoplastic enamel.*

- (i) *Pre-operative photographs and shade selection is required.*
- (ii) *Apply rubber dam or contoured matrix strips.*
- (iii) *Remove the demarcated lesion with a round diamond bur, down to the amelodentinal junction.*
- (iv) *Chamfer the enamel margins with a diamond fissure bur to increase the surface area available for retention.*
- (v) *Etch the enamel margins, wash and dry.*
- (vi) *Apply dentine primer.*
- (vii) *Apply enamel and dentine bonding agent and light cure.*
- (viii) *Apply chosen shade of composite using a brush lubricated with the bonding agent to smooth and shape and light cure for the recommended time.*
- (ix) *Remove the matrix strip or rubber dam.*
- (x) *Polish with Soflex discs, finishing burs and inter-proximal strips if required. Add characterisation to the surface of the composite if required.*
- (vi) *Post-operative photographs.*

#### **1.5.2 Composite Veneers**

*Most composite veneers placed in children and adolescents are of the direct type, as currently the durability of the indirect composite veneers is still being assessed.*

- (i) *Use a tapered diamond bur to reduce labial enamel thickness by 0.3-0.5mm. Removal of some enamel will increase the bond strength of composite to enamel(68). Identify a finish line at the gingival margin and also mesially and distally just labial to the contact points.*
- (ii) *Clean tooth with a slurry of pumice in water. Wash and dry the tooth. Select the shade.*
- (iii) *Isolate the tooth either with rubber dam or contoured matrix strip.*
- (iv) *Etch the enamel for 60 secs, wash and dry.*
- (v) *Apply a dentine bonding agent to any exposed dentine.*
- (vi) *Apply a thin layer of bonding resin to the labial surface with a brush and gently blow it with the air syringe. Cure for 15 secs.*
- (v) *Apply composite resin of the desired shade to the labial surface and roughly shape it into all areas with a plastic instrument before using a brush lubricated with unfilled resin to 'paddle' and smooth it into the desired shape. Cure 60 secs gingivally, mesio-incisally, and disto-incisally, In addition cure 60 secs inciso-palatally if there has been extension to the palatal surface. Different shades of composite can be combined to achieve a transition from darker gingival areas to lighter more translucent incisal regions.*
- (vi) *Finish the margins with diamond finishing burs and interproximal strips and the labial surfaces with graded sandpaper discs. Characterisation should be added to improve light reflection properties.*

## **1.6 PORCELAIN VENEERS**

*For further information on the appropriate use of porcelain veneers see "Restorative Indications for Porcelain Veneer Restoration", the National Clinical Guidelines, The Royal College of Surgeons (Eng. 1997).*

## REFERENCES

1. Smith, V.H., McInnes, J.W.  
Further Studies on Methods of Removing Brown Stains from Mottled Teeth.  
J. Am. Dent. Assoc. 1942; **29**: 571-576
2. Ames, J.W.  
Removing Stains from Mottled Enamel  
J. Am. Dent. Assoc. 1937; **24**: 1674-1677
3. Welbury, R.R., Shaw, L.  
A Simple Technique for Removing Mottling, opacities and Pigmentation from Enamel.  
Dent. Update. May 1990
4. McCloskey, R.J.  
A Technique for Removal of Fluorosis Stains.  
J. Am. Dent. Assoc. 1984; **109**: 63-64
5. Croll, T.P., Cavanaugh, R.R.  
Enamel Colour Modification by Controlled Hydrochloric Acid-Pumice Abrasion I, Technique and Examples.  
Quint. Int., 1986; **17**, No. 2.: 81-87
6. Croll, T.P., Cavanaugh, R.R.  
Enamel Colour Modification by Controlled Hydrochloric Acid-Pumice Abrasion II, Further Examples.  
Quint. Int., 1986; **17**, No. 3: 157-164
7. Kendall, R.L.  
Hydrochloric Acid Removal of Brown Fluorosis Stains: Clinical and Scanning Electron Micrographic Observations.  
Quint. Int., 1989; **20**, No. 11: 837-840
8. Olin, P.S., Lehner, C.R., Hilton, J.A.  
Enamel Surface Modification in Vitro using Hydrochloric Acid and Pumice: an SEM Investigation.  
Quint. Int., 1988; **19**, No. 10: 733-736
9. Waggoner, W.F. et. al..  
Microabrasion of Human Enamel in Vitro Using Hydrochloric Acid and Pumice.  
Paed. Dent., Dec 1989; **17**, No. 4: 319-323
10. Croll, T.P., Cavanaugh, R.R.  
Hydrochloric Acid-Pumice Enamel Surface Abrasion for Colour Modification: Results After 6 Months.  
Quint. Int., 1986; **17**: 335-341
11. Croll, T.P.



- A Case of Enamel Colour Modification: 60 Year Results.  
Quint. Int., 1987; **18**: 493-495
- 12.Chen, J.H., Wu, X.J., Xi, S.C., You, G.F.  
Scanning Electron Micrographic Analysis of the Effect of Bleaching Solutions on Fluorosed Enamel.  
Quint. Int., 1989; **20**: 825-829
- 13.Donly, K.J., O'Neill, M.O., Cross, T.P.  
Enamel Microabrasion: A Microscopic Evaluation of the 'Abrosion Effect'.  
Quint. Int., 1992; **23**: 175-179
- 14.Jacobsson-Hunt, U., Harrison, M.R.  
The Effect of Hydrochloric Acid Pumice Abrasion on Fluorosed Teeth.  
J. Dent. Res., 1989; **68**: 982, Abs. No. 924
- 15.Kapila, S., Currier, G.F.  
Hydrochloric Acid-Pumice Treatment for Post Orthodontic Localised Decalcification.  
Am. J. Dent., 1988; **1**: 15-19
- 16.Kilpatrick, N.M., Welbury, R.R.  
A 4 Year Follow-Up of the Hydrochloric Acid-Pumice Microabrasion Technique for the Removal of Enamel Pigmentation.  
Dent. Update, 1993; **20**: 105-107
- 17.Croll, T.P.  
Enamel Microabrasion for Removal of Superficial Dysmineralisation and Decalcification Defects.  
J. Am Dent Assoc **120**: 411-415
- 18.Pourghadiri, M., Longhurst, P., Watson, T.F.  
A New Technique for the Controlled Removal of Mottled Enamel: Measurement of Enamel Loss.  
Br. Dent. J., 1988; **184**: 239-241
- 19.Fisher, N.L., Radford, J.R.  
Internal Bleaching of Discoloured Teeth.  
Dent. Update, April 1990; 110-114
- 20.Nutting, E.B., Poe, G.S.  
Chemical Bleaching of Discoloured Endodontically Treated Teeth.  
Dent. Clin. North Am.; November 1967; 655-662
- 21.Feiglin, B.  
A 6-Year recall Study of Clinically Chemically Bleached Teeth.  
Oral Surg., May 1987; **63**: 610-613
- 22.Pearson, H.H.  
Bleaching of the Discoloured Pulpless Teeth.  
J. Am Dent .Assoc January 1958; **56**: 64-68
- 23.Howell, R.A.  
Bleaching Discoloured Root-Filled Teeth.  
Brit. Dent. J., 1980; **148**: 159-162

24. Brown, G.  
Factors Influencing the Successful Bleaching of the Discoloured Root-Filled Tooth.  
Oral Surg., Oral Med. and Oral Path., August 1965; **20**: 238-244
25. Howell, R.A.  
The Prognosis of Bleached Root-Filled Teeth.  
Int. Endod. J., 1981; **14**: 22-26
26. Harrington, G.W., Natkin, E.  
External Resorption Associated with Bleaching of Pulpless Teeth.  
J. Endod., 1979; **5**: 344-348
27. Lado, E.A., Stanley, H.R., Weisman, H.I.  
Cervical Resorption in Bleached Teeth.  
Oral Surg., 1983; **55**: 78-80
28. Cvek, M., Lindvall, A.M.  
External Root Resorption Following Bleaching of Pulpless Teeth with Oxygen Peroxide.  
Endod. Dent. Traumatol., 1985; **1**: 56-60
29. Montgomery, S.  
External Cervical Resorption After Bleaching a Pulpless Tooth.  
Oral Surg., February 1984; **57**: 203-206
30. Holmstrup, G., Palm, A.M., Lambjerg-Hansen, H.  
Bleaching of Discoloured Root-Filled Teeth.  
Endod. Dent. Traumatol., 1988; **4**: 197-201
31. Fredman, S., Rotstein, I., Libfeld, H., Stabholz, A., Heling, I.  
Incidence of External Root Resorption and Esthetic Results in 58 Bleached Pulpless Teeth.  
Endod. Dent. Traumatol., 1988; **4**: 23-26
32. Gimlin, D.R., Schindler, W.G.  
The Management of Post Bleaching Cervical Resorption.  
J. Endod., 1990; **16**: 292-297
33. Latcham, N.L.  
Management of a Patient with Severe Post Bleaching Cervical Resorption: A Clinical Report.  
J. Pros. Dent., 1991; **65**: 603-605
34. Goon, W.W.Y., Cohen, S., Borer, R.F.  
External Cervical Root Resorption Following Bleaching.  
J. Endod., 1986; **12**: 414-418
35. Latcham, N.L.  
Post Bleaching Cervical Resorption.  
J. Endod., 1986; **12**: 262-264

36. Weiger, R., Kuhn, A., Lost, C.  
Effect of Various Types of Sodium Perborate on the pH of Bleaching Agents.  
J. Endod., 1993; **19**: 239-241
37. Rotstein, I., Mor, C., Fredman, S.  
Prognosis of Intra-Coronal Bleaching with Sodium Perborate Preparations in Vitro: 1-Year Study.  
J. Endod., 1993; **19**: 10-12
38. Macey-Dove, L.V., Williams, B.  
Bleaching of a Discoloured Non-Vital Tooth: Use of Sodium Perborate/Water Paste as the Bleaching Agent.  
Int. J. Paed Dent., 1997; **7**:35-38
39. Kehoe, J.C.  
pH reversal following in vitro bleaching of pulpless teeth.  
Journal of Endodontics., 1987; **13**:6-9
40. Nathanson, D.  
Bleaching Vital Teeth: A Review and Clinical Study.  
Compend. Contin. Educ. Dent., **VIII**, No. 7: 400-497
41. Swift, E.J.  
A Method of Bleaching Discoloured Teeth.  
Quintessence Int., 1988; **19**, No. 9: 607-610
42. Titley, K.  
The Effect of Concentration of Hydrogen Peroxide Solutions on the Surface Morphology of Human Tooth Enamel.  
J. Endod., Feb. 1998; **14**, No. 2: 69-73
43. Rosentiel, et.al.  
In vitro Colour Change with Repeated Bleaching.  
Quintessence Int., 1991; **20**: 7-12
44. Bowles, W.M., Thompson, L.R.  
Vital Bleaching: The Effects of Heat and Hydrogen Peroxide on Pulpal Enzymes.  
J. Endod., 1986; **12**: 108-112
45. Robertson, W.B., Melfi, R.C.  
Pulpal Response to Vital Bleaching Procedures.  
J. Endod., 1980; **6**: 645-649
46. Cohen, S.C.  
Human Pulpal Response to Bleaching Procedures on Vital Teeth.  
J. Endod., 1979; **5**: 134-138
47. Barghi, N.  
Making a Clinical Decision for Vital Tooth Bleaching: At home or In-Office.  
Compend., August 1998; **19**: 831-838
48. Haywood Van, B., Heymann, H.O.

- Nightguard Vital Bleaching.  
Quint. Int., 1989; **20**: 173-176
49. Haywood Van, B., Leach, T., Heymann, H.O., Crumpler, D., Bruggers, K.  
Nightguard Vital Bleaching: Effects on Enamel Surface Texture and Diffusion.  
Quint. Int., 1990; **21**: 801-804
50. Haywood Van, B., Houck, V.M., Heymann, H.O.  
Nightguard Vital Bleaching. Effects of Various Solutions on Enamel Surface Texture and Colour.  
Quint. Int., 1991; **22**: 775-782
51. Cooley, R.L., Burger, K.M.  
Effect of Carbamide peroxide on Composite Resins.  
Quint. Int., 1991; **22**: 817-821
52. Haywood Van, B., Heymann, H.O.  
Nightguard Vital Bleaching: How Safe Is It?  
Quint. Int., 1991; **22**: 515-523
53. Haywood Van, B., Houck, V.M., Heymann, H.O.  
Effects of Various Nightguard Bleaching Solutions on Enamel Surfaces and Colour Change.  
J. Dent. Res., 1991; **70**: 377 Abst. No. 893
54. Croll, T.P.  
Enamel Microabrasion Followed by Dental Bleaching: Case Reports.  
Quint. Int., 1992; **23**: 317-321
55. Cvitki, E., Swift, E.J., Denehy, G. E.  
Improved Esthetics with a Combined Bleaching Technique: A Case Report.  
Quint. Int., 1992; **23**: 91-93
56. Haywood Van, B.  
The Safety and Effectiveness of Bleaching Teeth and Nightguard Vital Bleaching.  
Quint. Int., 1992; **23**: 471-488
57. Bailey, S.J., Swift, E.J.  
Effects of Home Bleaching Products on Composites.  
Quint. Int., 1992; **23**: 489-494
58. Leonard, R.H.  
Efficacy, Longevity, Side Effects and Patient Perceptions of NightGuard Vital Bleaching.  
Compend., August 1998; **19**: 776-781
59. Li, Y.  
Tooth Bleaching using Peroxide-Containing Agents: Current Status of Safety Issues.  
Compend., August 1998; **19**: 783-794
60. Frazier, K.B.

- Nightguard Bleaching to Lighten a Restored, Non-Vital Discoloured Tooth.  
Compend., August 1998; **19**: 810-813
61. Swift, E.J., Perdigo, J.  
Effects of Bleaching on Teeth and Restoration.  
Compend., August 1998; **19**: 815-820
62. Dunn, J.R.  
Dentist-Prescribed Home Bleaching: Current Status.  
Compend., August 1998; **19**: 760-764
63. Kellegher M G D, Roe F J C. The safety-in-use of 10% carbamide peroxide (Opalescence) for bleaching teeth under the supervision of a dentist.  
Br Dent J 1999; **187**: 190-194
64. Jordan, R.E., Suzuki, M. et.al.  
Restoration of Fractured and Hypoplastic Incisors by an Acid Etch Technique.  
J. Am Dent Assoc, 1977; **95**: 795
65. Jordan, R.E., Suzuki, M. et.al.  
Conservation Application of Acid Etch Techniques.  
Dent. Clin. North Am., 1981; **25**: 325-329
66. Welbury, R.R.  
A Clinical Study of a Microfilled Composite Resin for Labial Veneers.  
Int. J. Paed. Dent., 1991; **1**: 7-14
67. Harley, K., Ibbetson, R.  
Anterior Veneers for the Adolescent Patient. Part I. General indications and Composite Veneer.  
Dent. Update, March 1991
68. Aker D.A, Aker J.R , Sorenson S.E.  
Effects of methods of tooth enamel preparation on the retentive strength of acid etched composite resins.  
J. Am Dent Assoc, 1979; **99**: 195-197
69. Restorative indications for Porcelain Veneer Restoration. In 'National Clinical Guidelines' Royal College of Surgeons of England 1997.