PCT

WORLD INTELLECTUAL PROPERTY ORGANIZATION
International Bureau

INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification 6 : A61C 5/00

A1

(11) International Publication Number: WO 00/09030

(43) International Publication Date: 24 February 2000 (24.02.00)

(21) International Application Number: PCT/US99/17879

(22) International Filing Date: 6 August 1999 (06.08.99)

(30) Priority Data:

60/096,122	10 August 1998 (10.08.98)	US
60/144,521	19 July 1999 (19.07.99)	US

(71)(72) Applicant and Inventor: LYTINAS, Michail [GR/US]; Apartment No. 121, 62 Boylston Street, Boston, MA 02116 (US).

(74) Agent: BLECHER, Melvin; 4329 Van Ness Street, N.W., Washington, DC 20016-5625 (US).

(81) Designated States: AE, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CU, CZ, DE, DK, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, UA, UG, US, UZ, VN, YU, ZA, ZW, ARIPO patent (GH, GM, KE, LS, MW, SD, SL, SZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG).

Published

With international search report.
With amended claims and statement.

(54) Title: DENTAL TREATMENT METHODS

(57) Abstract

Disclosed are two methods for coating teeth so as to protect the tooth surfaces from caries and periodontal diseases and optionally paints teeth at a desired color. The anti–caries protection is due to the blocking of the enamel minerals that exit the enamel in order to balance the acidic environment that is created by the bacteria acids. The periodontal diseases protection is due to the low surface tension that is created after the application of specific substances on the enamel, i.e., makes the enamel more slippery. The painting effect comes from the colors that the applied substances have. One embodiment includes three steps: etching of the teeth, application of the protective and painting substance and sealing of the teeth (optional). Another embodiment relates to the implantation of a material in the outer layer of the tooth enamel or dentin or cementum and involves an implantable material, polymer or ceramic, fixed in place by use of a dental laser or a flame. This method also includes three steps: the dental tissue is etched and dried, the material is applied into the tissue, the laser beam or the flame melts the material into the tissue and finally the irradiated spot is air dried.

FOR THE PURPOSES OF INFORMATION ONLY

Codes used to identify States party to the PCT on the front pages of pamphlets publishing international applications under the PCT.

AL	Albania	**ES**	Spain	**LS**	Lesotho	**SI**	Slovenia
AM	Armenia	**FI**	Finland	**LT**	Lithuania	**SK**	Slovakia
AT	Austria	**FR**	France	**LU**	Luxembourg	**SN**	Senegal
AU	Australia	**GA**	Gabon	**LV**	Latvia	**SZ**	Swaziland
AZ	Azerbaijan	**GB**	United Kingdom	**MC**	Monaco	**TD**	Chad
BA	Bosnia and Herzegovina	**GE**	Georgia	**MD**	Republic of Moldova	**TG**	Togo
BB	Barbados	**GH**	Ghana	**MG**	Madagascar	**TJ**	Tajikistan
BE	Belgium	**GN**	Guinea	**MK**	The former Yugoslav Republic of Macedonia	**TM**	Turkmenistan
BF	Burkina Faso	**GR**	Greece			**TR**	Turkey
BG	Bulgaria	**HU**	Hungary	**ML**	Mali	**TT**	Trinidad and Tobago
BJ	Benin	**IE**	Ireland	**MN**	Mongolia	**UA**	Ukraine
BR	Brazil	**IL**	Israel	**MR**	Mauritania	**UG**	Uganda
BY	Belarus	**IS**	Iceland	**MW**	Malawi	**US**	United States of America
CA	Canada	**IT**	Italy	**MX**	Mexico	**UZ**	Uzbekistan
CF	Central African Republic	**JP**	Japan	**NE**	Niger	**VN**	Viet Nam
CG	Congo	**KE**	Kenya	**NL**	Netherlands	**YU**	Yugoslavia
CH	Switzerland	**KG**	Kyrgyzstan	**NO**	Norway	**ZW**	Zimbabwe
CI	Côte d'Ivoire	**KP**	Democratic People's Republic of Korea	**NZ**	New Zealand		
CM	Cameroon			**PL**	Poland		
CN	China	**KR**	Republic of Korea	**PT**	Portugal		
CU	Cuba	**KZ**	Kazakstan	**RO**	Romania		
CZ	Czech Republic	**LC**	Saint Lucia	**RU**	Russian Federation		
DE	Germany	**LI**	Liechtenstein	**SD**	Sudan		
DK	Denmark	**LK**	Sri Lanka	**SE**	Sweden		
EE	Estonia	**LR**	Liberia	**SG**	Singapore		

DENTAL TREATMENT METHODS

BACKGROUND OF THE INVENTION

Two related methods of treating the teeth are presented herein. The first embodiment of the present invention relates to a teeth-coating method that protects teeth from caries and periodontal diseases along with giving color to them. The method includes three steps: create space into the teeth by etching them, apply the protecting and coloring substances and sealing of the teeth (optional). The protection is due to the blocking of the dental enamel minerals that exit from teeth in order to balance the pH of the tooth environment (anti-caries) and due to the low surface tension that these substances create in the enamel surface which make the enamel practically uncollonizable by the bacteria (anti-periodontal diseases). The coloring is due to the colors that these substances can have. By applying these substances, the teeth are practically painted in a desired color, at the same time that they are protected.

The second embodiment of the present invention relates to the implantation of a material in the outer layer of the tooth enamel or dentin or cementum and involves an implantable material, polymer or ceramic, fixed in place by use of a dental laser or a flame. This method also includes three steps: the dental tissue is etched and dried, the material is applied into the tissue, the laser beam or the flame melts the material into the tissue and finally the irradiated spot is air dried. This method protects the teeth from dental caries and periodontal diseases, paints the teeth at a desired shade and the implantable material can be used as a filling material itself.

The protection of the teeth from caries is due to the blocking of the dental minerals that exit the tooth in order to balance the pH of the tooth environment.

The protection from periodontal diseases is due to the low surface tension that the implantable materials create in the enamel surface which make the enamel practically uncolonizable to the bacteria. The painting of the teeth is due to the shades that the implantable materials have and can be used to give the teeth a desired tint. A material with properties similar to the enamel or dentin or cementum can be used as a filling material itself in dental cavities.

Defining the etiology of dental caries and periodontal diseases is the primary purpose. Dental research has proved the significance of the microflora and its causation to dental caries and periodontal diseases. Bacteria populations first colonize the teeth's surfaces and then they produce acids. Due to these acids, the new environment between enamel and bacteria has a newly formed lower pH, which causes the enamel to lose mineral content. This interaction takes place from the enamel to the bacteria and starts from the intraprismatic area, between the rods of the hydroxyapatite. The continuous loss of the enamel minerals leads eventually to a decayed or carious tooth. These same acids also interact with periodontal tissues. If the colonies are not mechanically removed by a toothbrush or a dentist, they become bigger, more organized and gram negative, making the acids which they produce, stronger. As a result, these acids enter the gums causing inflammation, which can lead to bone loss and / or eventually to tooth loss.

The shade of the teeth is a very important esthetic factor. Liquids like coffee and cola, use of tetracycline in pregnancy and in early childhood, aging, endodontic treatment and many other staining factors darken the teeth. To this problem, dental bleaching gives an answer. This technique, though, has several defects. Rebound of the shade, sensitivity of the tooth, existing bleaching materials do not bleach composite restorations or, in some cases they have no results at all.

The interface between the restorative material and the tooth is a well studied field. Many compounds like composites, ceramics or even amalgam are in use today having the same problems: the microleakage and the wear of the restoration. These problems arise from the difference of the properties between the tooth tissues and the restorative materials. Different coefficient of linear thermal expansion, different hardness, different tear strength are some of the most important factors that lead the restoration to failure.

In order to prevent dental caries and periodontal diseases scientists had previously followed two directions:

1. The co-operation with the patient,

2. The intervention in oral health of the individuals without co-operation.

The co-operation with the patient includes oral hygiene for the plaque control (brushing, flossing, fluoride rinses, gels) and dietary control. Sometimes it is necessary to change the whole nutritional habits of a certain population.

The scientifically based intervention in oral health submits plaque control, fluoridation of the water, dental-induced application of fluoride and sealants for the enhancement of the enamel.

Fluoride prevents dental caries in two ways:

1: When applied to the enamel, it is believed that fluoride makes the enamel less soluble to bacteria acids, by penetrating the enamel and changing hydroxyapatite to fluoroapatite.

2: Blocks the enolase, an enzyme that enhances the metabolic activity of the bacteria.

Oral hygiene prevents dental caries and periodontal diseases by removing the dental plaque. No bacteria populations means no damage to the tooth. It is important to brush teeth after every meal in order to remove especially the sugars of the food, that are one of the most important factor for the adherence of the bacteria to the enamel. This is due to sugars high-energy chemical bond (Gh=-6600cal/mole) which is used form the bacteria to their multiplicity, and due also to the capability of the sugars to adhere smooth-like surfaces, like enamel surface.

According to these directions caries and periodontal diseases should have been eliminated. It is a fact that the prevalence of these diseases has been decreased, especially in children, but we are far from postulating that there is no caries or periodontal diseases any more.

The reasons are the ineffectiveness of the fluoride-oriented preventive treatment and the unwillingness of the individual to follow an everyday oral hygiene. Practically, decayed teeth or periodontal diseases do appear in very clean oral cavities.

The results of fluoride application are not only the enhanced fluorided hydroxy apatite of the enamel but also CaF_2 and 6($CaHPO_4$) which are very soluble to saliva. This explains why most of the fluoride dissolves in minutes after its application to teeth. On the other hand, the fluoride blocks the enolase when it is in an ionic phase, something which rarely happens, because most of the fluoride immediately bonds with the minerals of the plaque and become inactive. These are mainly the reasons why most of today's teeth protective techniques are eventually ineffective.

Sealants have used to prevent pit and fissures caries in children. The preventive value of sealant have been thoroughly examined and proved. The problem, though, of caries and periodontal diseases still exists, especially in adult population.

On the other hand nobody can force a patient to comply with the oral hygiene methods. This unwillingness of the individuals leads to longer exposure of the enamel to the bacteria acids and respectively to caries and periodontal diseases.

The critical pH (5.3-5.5) of the dental plaque and the enamel surface must not be decreased for long time. When this happens, minerals from the enamel move towards the dental plaque to balance the new environment's conditions. After 20-40 minutes this pH returns to its previous number. That means that the enamel starts to be remineralized again from the saliva adjustment mechanisms. This remineralization takes 3-5 hours to be completed. If between these hours, a second decrease of the pH occurs -due to food- the enamel doesn't have time to complete remineralization. This results in a second minerals offering, which finally weakens the enamel and create caries.

SUMMARY OF THE INVENTION

The present invention eliminates all these problems because the protective substance is embedded into the teeth and sealed there. It changes the environmental conditions by making the enamel practically unsoluble to the bacteria acids (blocking the enamel minerals) and making the colonization of the teeth nearly impossible (low surface tension).

In the first preferred embodiment, the present invention is a teeth-coating method that protects teeth from caries and periodontal diseases and at the same time paints the teeth. There are three steps:

a. Etching of the teeth. There are already known etching techniques that dentists use in today's dentistry. Etching gels or etching liquids including phosphoric and citric acids or others that can be easily applied to the teeth. Laser induced etching can be also used with various types of laser beams. The teeth are all over etched in all their surfaces especially the more sensitive ones like interproximal and in pits and fissures. If there is periodontitis involved in a certain tooth, even cementum must be etched in order to be later coated and protected. The depth of the etching is closely related to the penetration ability of the application technique (step #2) and the penetration ability of the substance that will be used in the second step. That depth varies from a few microns to half a millimeter.

b. Application of the substance. This substance can be a polymer or a salt that contains fluoride or metals. The application technique is electrophoresis, spraying or just application of the substance to the teeth. The application technique is related to the nature of the substance, i.e. to the penetration ability of the specific substance into the enamel. If a substance can give a polar solution, electrophoresis is the best application technique. If a substance can be sprayed, spraying is the best solution. Every technique is accepted if can result in a minimum penetration into the enamel. After the application of the particular substance, a second light etching is needed, in order to create some space for the sealing. This step is not necessary if there is space left. In case the used substance has sealing or glazing characteristics the following step is not necessary.

c. Sealing of the teeth. After the application of the protective and coloring substance the teeth must be sealed. Various glazes, curable or not, can be used, in order to seal the teeth.

The protective substances may advantageously also have color additives, so that their application into the teeth leads to the cosmetic painting of the teeth. Various types of white color or other colors can be used to add a new tint to the teeth.

Today's whitening methods are based in the hydroxy peroxide that oxidizes the enamel minerals resulting in the bleaching of the teeth. This bleaching method is not sufficient because the teeth turn dark again in a few weeks, due to the color of the coffee, the food, or the cigarette.

The present invention is not based on the oxidation of the enamel minerals but practically paints the tooth in the desired color. The same substances that are used for the protection of the teeth can be used to give a desired color to the teeth. The new color lasts longer than the simple bleaching because the discoloration of the food and the drinks cannot be attached to the teeth due to the newly formed low surface tension.

The second preferred embodiment of the present invention relates to the implantation of a thermoplastic polymer or a ceramic into the outer layer of the dental enamel, dentin or cementum. This method includes three steps:

1. The dental tissue is etched and dried. The part of the tooth that is etched depends on the application. For caries and periodontal diseases protection, the whole tooth must be etched especially interproximally and in pits and fissures. For the painting of the teeth the etched space relies on the esthetic ideal, because the etched space will accept the desired shade. For the use of a ceramic or a specific polymer as a filling material the etched part is defined by the margins of the restoration. The drying of the etched tooth is performed after the etching and can be done by air or a lower wattage laser beam.

2. The application of the specific material for the specific application is performed by air spraying the material into the etched dental tissue. The material must be in fine powder so that it can permeate the etched tooth especially between the hydroxyapatite rods.

3. The proper laser beam, adjusted in the proper settings for every application, scans the tooth and melts the material instantaneously into the tooth. Right after the melting, the lased part of the tooth is air dried. The flame must reach the melting point of each material and must not damage the material or the tissue from overheating.

In the second preferred embodiment of the present invention, the problems of the past are eliminated because:

a. the implanted material blocks the exit of the dental minerals from the enamel and especially the intraprismatic space of the enamel –anti caries protection;

b. the implanted material has very high chemical resistance and creates a very low surface tension to the tooth tissues which make the tooth uncolonizable to the bacteria –anti periodontal diseases protection;

c. the implanted materials have a broad range in colors and can be used to give the teeth the desired shade–painting method;

d. the implanted material creates an alloy with the tooth tissues as it is co-melted with them, making the restoration, a part of the tooth –restorative material.

In the second preferred embodiment, the implantable material is a polymer or a ceramic that can be melted into the tooth. For caries and perio protection the polymers are preferable because of the excellent chemical resistance and the low surface tension that create to the tooth enamel, making it uncolonizable to bacteria. For the painting of the teeth the polymers are preferable again because of the versatility of their use and the wide shade range that they have. For dental restorations the ceramics are preferable because of the non-existence of microleakage –due to the co-melting of the ceramic and the tissue- and the vicinity of properties between dental tissues and ceramics.

The laser beam must be adjusted to the properties of every dental tissue to which it refers. The wavelength of the laser must be the same that every dental tissue absorbs (i.e., 9.3 – 9.6 μm for the enamel or 6-7.5 μm for the dentin). This fact gives the dentist the opportunity to heat the dental tissue to that point where each material melts. The specific wavelength which every dental tissue fully absorbs makes that specific tissue unable to transmit the laser wave deeper into the tooth and consequently hurt the pulp of the tooth.

Every dental tissue has a specific thermal damage envelope. The melting of the implantable material -polymer or ceramic- must coordinate with this envelope. That means that the melting of the material must happen instantaneously in order to avoid the damage of the tissue which can arise from prolonged time of irradiation.

The thermal relaxation time of every tissue must be followed too. Therefore, the laser beam, can be either pulsed or continuous. That depends on the application. For laser melting the pulsed mode is preferable because it gives the tooth time to coo, especially in the restorative application. For laser drying after etching even continuous mode can be used because of the low wattage of the laser.

The flame must reach the melting point of each material and must not char or damage the implantable material or the tissue.

DETAILED DESCRIPTION OF THE INVENTION

As described above, the first preferred embodiment of the present invention is a teeth-coating method that protects teeth from dental caries and periodontal diseases and optionally also paints teeth at a desired color. This coating method consists of the following steps:

a. etching the teeth, for example by acid, laser, or other methods available to dentists;

b. application of the protective substance and any optionally desired coloring substance to the etched teeth, by any of the methods available to dentists.

c. sealing the teeth, by any of the methods available to dentists. This step depends on the nature of the protective and coloring substance because many substances have sealing characteristics. If that happens, additional sealing is not necessary.

The etching of the teeth can be performed by the already known techniques, e.g., acid or laser induced. The etching step is essential because there must be enough space for the second step, the application of the protective substances. The entire exposed surface of the teeth must be etched, in order to provide adequate protection. Another etching procedure that can be employed herein is the "air abrasion" option. These techniques are discussed in detail in the dental literature, and several references are recited below.

For acid etching, commonly employed materials include phosphoric acid, maleic acid, citric acid, pyruvic acid, and the like. For laser etching, common lasers used are the CO_2, Nd/Yag, Ar:F and others.

Advantageously, known techniques are used for an overall etching, at a sufficient depth that will accommodate the protective substances and any optional colorants. Special care should also be given to those places that are more prone to develop caries like interproximately and in pits and fissures, or in the places that already have or are more prone to develop periodontitis (in some cases even cementum must be protected). The etching depth is closely related to the penetration ability and the application technique of the protective substances which will be applied after the etching step. Finally, the quality of the tooth enamel is another factor, which will vary on a patient by patient basis. Usually, an etching depth of about 50 microns (μm) is adequate for most aspects of the present invention.

The application of the protective substance (and optional coloring substances) can be performed by various techniques depending on the nature of the substance used. Electrophoresis, spraying, or any other technique that results in the penetration of the substance into the enamel. This penetration can vary from a few microns to half a millimeter depending on the etching technique that is previously used and the penetration ability that every substance has. The total depth of the penetration is closely related to the protection degree that every substance has. More protective characteristics mean less depth and vice versa.

Commonly employed protective substances include the water soluble polymers (xanthan and others), other polymers, salts (e.g., ZnF, CaF, NaF and others), oxides (ZrO_2, TiO_2 and others), cellulose products (cellulose acetate and others), proteins, polyurethane solid coatings, composites (Bisphenol A-Glycidyl Methacrylate and others), resins (Bis-GMA and others).

The final step is the sealing of the teeth. This step is necessary when protective substances with no sealing characteristics were previously used, and not necessary in case of protective substances with self-sealing characteristics. The sealing materials generally require some space in order to be applied, so if the protective (and optional colorant) substance has filled every space in the teeth, a second light etching will be required before the sealing. The sealing can be curable, like the already known glazes in dentistry or not. The sealing must hermetically seal the tooth's surface. One commonly employed sealer is available under the brand name "Fortify." Other sealers are also known and commercially available.

In the second preferred embodiment of the invention, a thermoplastic polymer or a meltable ceramic material is implanted into the tooth. The implantable polymer or ceramic, in fine powder, is air sprayed into the acid etched and laser dried tooth. A specific laser or a flame, adjusted in the proper settings, scans the tooth and instantaneously melts the polymer or the ceramic. The application ends with the air drying of the lased part of the tooth right after the melting.

The etching of the dental enamel, dentin or cementum is performed by acid or laser. Already used etching acids like phosphoric acid, maleic acid, citric acid, pyruvic acid can be used for this step. The laser etching can also be used, although not preferably, because of the melting that creates to the dental tissues. After the etching the etched dental tissue is dried by air or by laser. The laser is preferable because it does not create the piston phenomenon. In this case the air that flows into the intraprismatic area cannot reach and dry the bottom part of the tags because of the existing amount of air that is already pressed there in a higher pressure than the pressure of the air spray. The drying laser follows the same rules with the melting laser in a lower wattage.

The application of the implantable polymer or ceramic is performed by air spraying the material into the etched part of the tooth. The polymer or the ceramic is in fine powder so that it can permeate the tooth and rest into the tooth, especially between the rods of the apatite. The polymers that can be used must be thermoplastic in order to be melted using the laser or the flame. The melting point of the polymers and the ceramics must not exceed the melting point of the dental tissue that will be implanted in. The maximum melting point that any implantable material can have is the melting point of the dental tissue that will be implanted in. The material that is used every time, after the laser and the air drying, does not override the level of the tooth structure except the special polymer or the ceramic that is used as a restorative material and involves the co-melting of the material and the dental tissue. That includes mostly polymers that will be melted into the dental tissue -and their properties, especially wear resistance and tear strength are not close to the dental tissue's. In case of using this method for restorative purposes, the final level of the newly formed alloy (the dental tissue and the ceramic or some polymers) is the same. In this case the amount of the dental tissue that is removed from the etching corresponds to the amount of the material that is deposited and the result after the laser irradiation is an alloy of dental tissue and implanted material (ceramic or special polymer) that has the same dimensions with the part of the tooth where the application took place.

The laser or the flame is used actually to instantaneously heat the dental tissue or the implantable material (depends on the application) to a specific point where the melting point of the implantable material stands. The flame must not exceed the melting point of the implantable material. The laser -preferably used for restorative reasons- follows the thermal damage envelope of every dental tissue that will be used on. The wavelength of the laser that will be applied in any dental tissue must be fully absorbed by the specific dental tissue so that the laser energy is not transmitted into the pulp of the tooth. For example the wavelength that is fully absorbed by the enamel is 9.3-9.6 μm and can be delivered by a CO_2 dental laser. The wattage of the laser relates to the energy that the implantable material needs to be melted into the dental tissue or maximum needs the dental tissue along with the ceramic or the polymer to be melted together. The mode of the laser - continuous or pulsed- depends on the implantable materials and the thermal relaxation time of every dental tissue. For laser drying, continuous mode is preferable because the wattage is very low. For laser melting, pulsed mode is preferable because it gives the tooth time to cool. The spot diameter of the laser beam or the flame plays an important role in the amount of energy that is deposited into the dental tissue and can vary from 0.1 mm (for pits and fissures) to 1.5 mm for the wider areas of the tooth.

The drying of the melted material into the tooth is performed by air spraying. Right after the laser beam melts the polymer or the ceramic into the tooth, an air spray follows to cool down the tooth area that has accepted the implantation. This cooling down turns -progressively- the temperature of the irradiated spot back to the normal level.

The thermoplastic polymers that can be used in this invention are all the polymers that can be melted by a laser or a flame and their melting point does not exceed the melting point of the dental tissue that will receive this implantation. The ceramics follow the same rule. Every ceramic compound can be used if it can be melted by a laser or a flame and its melting point does not exceed the melting point of the dental tissue that will receive the implantation.

The following references are provided as additional information to assist the skilled artisan in further understanding and utilizing the present invention. The documents cited below are hereby incorporated herein by reference.

References for Sealants

1. Chisick MC. Poindexter FR. York AK. The need for and prevalence of dental sealants in active duty U.S. military personnel. Military Medicine. 163(3):155-8, 1998 Mar.

2. Bravo M. Baca P. Llodra JC. Osorio E. A 24-month study comparing sealant and fluoride varnish in caries reduction on different permanent first molar surfaces. Journal of Public Health Dentistry. 57(3):184-6, 1997 Summer. Health Sciences Library (Boston).

3. Anonymous. Dental sealants. ADA Council on Access, Prevention and Interprofessional Relations; ADA Council on Scientific Affairs. [Review] [24 refs] Journal of the American Dental Association. 128(4):485-8, 1997 Apr. Health Sciences Library (Boston).

4. Siegal MD. Farquhar CL. Bouchard JM. Dental sealants. Who needs them?. Public Health Reports. 112(2):98-106; discussion 107, 1997 Mar-Apr. Health Sciences Library (Boston).

5. Main PA. Lewis DW. Hawkins RJ. A survey of general dentists in Ontario, Part I: Sealant use and knowledge. Journal Canadian Dental Association. Journal de l Association Dentaire Canadienne. 63(7):542, 545-53, 1997 Jul-Aug. Health Sciences Library (Boston).

6. Ashby J. Bisphenol-A dental sealants: the inappropriateness of continued reference to a single female patient [letter; comment]. Environmental Health Perspectives. 105(4):362, 1997 Apr.

7. Gift HC. Drury TF. Nowjack-Raymer RE. Selwitz RH. The state of the nation's oral health: mid-decade assessment of Healthy People 2000. Journal of Public Health Dentistry. 56(2):84-91, 1996 Spring. Health Sciences Library (Boston).

8. Waggoner WF. Siegal M. Pit and fissure sealant application: updating the technique. [Review] [92 refs] Journal of the American Dental Association. 127(3):351-61, quiz 391-2, 1996 Mar. Health Sciences Library (Boston).

9. Anonymous. Dangerous dental sealants? [News]. Environmental Health Perspectives. 104(4):373-4, 1996 Apr.

10. Siegal MD. Garcia AI. Kandray DP. Giljahn LK. The use of dental sealants by Ohio dentists. Journal of Public Health Dentistry. 56(1):12-21, 1996 Winter. Health Sciences Library (Boston).

11. Clark MM. Album MM. Lloyd RW. Preventive dentistry and the family physician. [Review] [30 refs] American Family Physician. 53(2):619-26, 631-2, 1996 Feb 1. Health Sciences Library (Boston).

12. Selwitz RH. Winn DM. Kingman A. Zion GR. The prevalence of dental sealants in the US population: findings from NHANES III, 1988-1991. Journal of Dental Research. 75 Spec No:652-60, 1996 Feb. Health Sciences Library (Boston).

13. Soderholm KJ. The impact of recent changes in the epidemiology of dental caries on guidelines for the use of dental sealants: clinical perspectives [comment]. [Review] [84 refs] Journal of Public Health Dentistry. 55(5 Spec No):302-11, 1995. Health Sciences Library (Boston).

14. Rozier RG. The impact of recent changes in the epidemiology of dental caries on guidelines for the use of dental sealants: epidemiologic perspectives [comment]. [Review] [85 refs] Journal of Public Health Dentistry. 55(5 Spec. No):292-301, 1995. Health Sciences Library (Boston).

15. Brown LJ. Selwitz RH. The impact of recent changes in the epidemiology of dental caries on guidelines for the use of dental sealants [see comments]. [Review] [102 refs] Journal of Public Health Dentistry. 55(5 Spec No):274-91, 1995. Health Sciences Library (Boston).

16. Halterman CW. Rayman M. Rabbach V. Survey of pediatric dentists concerning dental sealants. Pediatric Dentistry. 17(7):455-6, 1995 Nov-Dec. Health Sciences Library (Boston).

17. Cherry-Peppers G. Gift HC. Brunelle JA. Snowden CB. Sealant use and dental utilization in U.S. children. ASDC Journal of Dentistry for Children. 62(4):250-5, 1995 Jul-Aug. Health Sciences Library (Boston).

18. Selwitz RH. Nowjack-Raymer R. Driscoll WS. Li SH. Evaluation after 4 years of the combined use of fluoride and dental sealants. Community Dentistry & Oral Epidemiology. 23(1):30-5, 1995 Feb. Health Sciences Library (Boston).

19. Faine MP. Oberg D. Survey of dental nutrition knowledge of WIC nutritionists and public health dental hygienists. Journal of the American Dietetic Association. 95(2):190-4, 1995 Feb.

20. Bowman PA. Zinner KL. Utah's parent, teacher, and physician sealant awareness surveys. Journal of Dental Hygiene. 68(6):279-85, 1994 Nov-Dec.

21. Lopez-Camara V. Irigoyen ME. Use of fissure sealants by dentists in private practice in Mexico City. International Journal of Paediatric Dentistry. 4(4):239-43, 1994 Dec.

22. Lokshin MF. Preventive oral health care: a review for family physicians [see comments]. [Review] [30 refs] American Family Physician. 50(8):1677-84, 1687, 1994 Dec. Health Sciences Library (Boston).

23. Rozier RG. Spratt CJ. Koch GG. Davies GM. The prevalence of dental

sealants in North Carolina schoolchildren. Journal of Public Health Dentistry. 54(3):177-83, 1994 Summer. Health Sciences Library (Boston).

24. Gift HC. Corbin SB. Nowjack-Raymer RE. Public knowledge of prevention of dental disease. Public Health Reports. 109(3):397-404, 1994 May-Jun. Health Sciences Library (Boston).

25. Love WC. Smith RS. Jackson E. Knuckles BN. Patton M. The efficacy of dental sealants for an adult population. Operative Dentistry. 18(5):195-202, 1993 Sep-Oct. Health Sciences Library (Boston).

26. Weintraub JA. Stearns SC. Burt BA. Beltran E. Eklund SA. A retrospective analysis of the cost-effectiveness of dental sealants in a children's health center. Social Science & Medicine. 36(11):1483-93, 1993 Jun. Health Sciences Library (Boston).

27. Newbrun E. Dental caries in the future: a global view. [Review] [25 refs] Proceedings of the Finnish Dental Society. 88(3-4):155-61, 1992. Health Sciences Library (Boston).

28. Soh G. Understanding prevention of dental caries and gum disease in the singapore population. Odonto-Stomatologie Tropicale. 15(1):25-9, 1992 Mar.

29. Soh G. Racial differences in perception of oral health and oral health behaviours in Singapore. International Dental Journal. 42(4):234-40, 1992 Aug. Health Sciences Library (Boston).

30. Bohaty B. Spencer P. Trends in dental treatment rendered under general anesthesia, 1978 to 1990. Journal of Clinical Pediatric Dentistry. 16(3):222-4, 1992 Spring. Health Sciences Library (Boston).

31. Kuthy RA. Clive JM. Comparison of number and mean charge between dental sealants and one-surface restorations. Journal of Public Health Dentistry. 52(4):227-31, 1992 Summer. Health Sciences Library (Boston).

32. Selwitz RH. Colley BJ. Rozier RG. Factors associated with parental acceptance of dental sealants. Journal of Public Health Dentistry. 52(3):137-45, 1992 Spring. Health Sciences Library (Boston).

33. Gillcrist JA. Collier DR. Wade GT. Dental caries and sealant prevalences in schoolchildren in Tennessee. Journal of Public Health Dentistry. 52(2):69-74, 1992 Winter. Health Sciences Library (Boston).

34. Rozier RG. Beck JD. Epidemiology of oral diseases. [Review] [27 refs] Current Opinion in Dentistry. 1(3):308-15, 1991 Jun.

35. Hamilton ME. Coulby WM. Oral health knowledge and habits of senior

elementary school students. Journal of Public Health Dentistry. 51(4):212-9, 1991 Fall. Health Sciences Library (Boston).

36. Johnsen DC. The role of the pediatrician in identifying and treating dental caries. Pediatric Clinics of North America. 38(5):1173-81, 1991 Oct. Health Sciences Library (Boston).

37. Soh G. Understanding prevention of dental caries and gum disease in an Asian community. Journal of the Irish Dental Association. 37(1):6-9, 1991.

38. Truhe TF. Dental sealants. [Review] [26 refs] New York State Dental Journal. 57(2):25 -7, 1991 Feb. Health Sciences Library (Boston).

39. Gerlach RW. Senning JH. Managing sealant utilization among insured populations: report from Vermont's "Tooth Fairy" program. ASDC Journal of Dentistry for Children. 58(1):46-9, 1991 Jan-Feb. Health Sciences Library (Boston).

40. Daniel SJ. Scruggs RR. Grady JJ. Accuracy of student self-evaluations of dental sealants. Journal of Dental Hygiene. 64(7):339-42, 1990 Sep.

41. Sterritt GR. Frew RA. Rozier RG. Brunelle JA. Evaluation of a school-based fluoride mouthrinsing and clinic-based sealant program on a non-fluoridated island. Community Dentistry & Oral Epidemiology. 18(6):288-93, 1990 Dec. Health Sciences Library (Boston).

42. Corbin SB. Clark NL. McClendon BJ. Snodgrass NK. Patterns of sealant delivery under variable third party requirements. Journal of Public Health Dentistry. 50(5):311-8, 1990 Fall. Health Sciences Library (Boston).

43. Kuthy RA. Branch LG. Clive JM. First permanent molar restoration differences between those with or without dental sealants. Journal of Dental Education. 54(11):653-60, 1990 Nov. Health Sciences Library (Boston).

44. Scruggs RR. Daniel SJ. Larkin A. Stoltz RF. Effects of specific criteria and calibration on examiner reliability. Journal of Dental Hygiene. 63(3):125-9, 1989 Mar.

45. Faine RC. Isman R. The use of dental sealants in the Washington State Medical Assistance Program: a second-year report. ASDC Journal of Dentistry for Children. 56(6):450-1, 1989 Nov-Dec. Health Sciences Library (Boston).

46. Kuthy RA. Ashton JJ. Eruption pattern of permanent molars: implications for school-based dental sealant programs. Journal of Public Health Dentistry. 49(1):7-14, 1989 Winter. Health Sciences Library (Boston).

47. Scott L. Brockmann S. Houston G. Tira D. Retention of dental sealants following the use of airpolishing and traditional cleaning. Dental Hygiene.

62(8):402-6, 1988 Sep. Health Sciences Library (Boston).

48. Daniel SJ. Scruggs RR. The reliability of three methods for evaluating dental sealants. Journal of Dental Education.51(4):182-5, 1987 Apr. Health Sciences Lib

49. Corbin SB. Maas WR. Kleinman DV. Backinger CL. 1985 NHIS findings on public knowledge and attitudes about oral diseases and preventive measures. Public Health Reports. 102(1):53-60, 1987 Jan-Feb. Health Sciences Library (Boston).

50. Daniel SJ. Grose MD. Scruggs RR. Stoltz RF. Examiner reliability in evaluating dental sealants. Dental Hygiene. 61(9):410-3, 1987 Sep. Health Sciences Library (Boston).

51. Bader JD. Sams DH. O'Neil EH. Estimates of the effects of a statewide sealant initiative on dentists' knowledge and attitudes. Journal of Public Health Dentistry. 47(4):186-92, 1987 Fall. Health Sciences Library (Boston).

52. Whyte RJ. Leake JL. Howley TP. Two-year follow-up of 11,000 dental sealants in first permanent molars in the Saskatchewan Health Dental Plan. Journal of Public Health Dentistry. 47(4):177-81, 1987 Fall. Health Sciences Library (Boston).

53. Faine RC. The use of dental sealants in the Washington State Medical Assistance Program: a one-year report. ASDC Journal of Dentistry for Children. 54(6):451-3, 1987 Nov-Dec. Health Sciences Library (Boston).

54. Duffy MB. Bernet JK. Chovanec GK. Majerus GJ. Frazier PJ. Newell KJ. Dental hygienists' knowledge, opinions, and use of pit and fissure sealants: a comparison of two states. Journal of Public Health Dentistry. 47(3):121-33, 1987 Summer. Health Sciences Library (Boston).

55. Flanders RA. Effectiveness of dental health educational programs in schools. Journal of the American Dental Association. 114(2):239-42, 1987 Feb. Health Sciences Library (Boston).

56. DiLeone CM. Dental sealants: information and guidelines for insurance carriers. Dental Hygiene. 61(1):18-23, 1987 Jan. Health Sciences Library (Boston).

57. Isman R. Kizer KW. Preventive dentistry update--dental sealants. Western Journal of Medicine. 146(5):631-2, 1987 May. Health Sciences Library (Boston).

58. Rubenstein LK. Dinius A. Dental sealant usage in Virginia. Journal of Public Health Dentistry. 46(3):147-51, 1986 Summer. Health Sciences Library (Boston).

59. Faine RC. Dennen T. A survey of private dental practitioners' utilization of dental sealants in Washington state. ASDC Journal of Dentistry for Children.

53(5):337-42, 1986 Sep-Oct. Health Sciences Library (Boston).

60. Glasrud PH. Insuring preventive dental care: are sealants included?. American Journal of Public Health. 75(3):285-6, 1985 Mar.

61. Anonymous. Dental sealants in the prevention of tooth decay. NIH Consensus Development Conference summary. British Dental Journal. 156(8):295-8, 1984 Apr 21. Health Sciences Library (Boston).

62. Anonymous. Dental sealants in the prevention of tooth decay. National Institutes of Health Consensus Development Conference statement. Journal - Connecticut State Dental Association. 58(2):62-9, 1984 May. Health Sciences Library (Boston).

63. Anonymous. Dental sealants in the prevention of tooth decay. [Review] [0 refs] National Institutes of Health Consensus Development Conference Summary. 4(11):9 p., 1984. Health Sciences Library (Boston).

64. Koop CE. Dental sealants. Journal of Public Health Dentistry. 44(3):126, 1984 Summer. Health Sciences Library (Boston).

65. Anonymous. Consensus development conference statement on dental sealants in the prevention of tooth decay. National Institutes of Health. Journal of the American Dental Association. 108(2):233-6, 1984 Feb. Health Sciences Library (Boston).

66. Stamm JW. Is there a need for dental sealants? Epidemiological indications in the 1980s. Journal of Dental Education. 48(2 Suppl):9-17, 1984 Feb. Health Sciences Library (Boston).

67. Anonymous. National Institutes of Health Consensus Development conference Statement. Dental sealants in the prevention of tooth decay. Journal of Dental Education. 48(2 Suppl):126-31, 1984 Feb. Health Sciences Library (Boston).

68. Jeronimus DJ Jr. Till MJ. Sveen OB. Reduced viability of microorganisms under dental sealants. ASDC Journal of Dentistry for Children. 42(4):275-80, 1975 Jul-Aug. Health Sciences Library (Boston).

69. A. Munro GA. Hilton TJ. Hermesch CB. In vitro microleakage of etched and rebonded Class 5 composite resin restorations. Operative Dentistry. 21(5):203-8, 1996 Sep-Oct. Health Sciences Library (Boston).

70. B. May KN Jr. Swift EJ Jr. Wilder AD Jr. Futrell SC. Effect of a surface sealant on microleakage of Class V restorations. American Journal of Dentistry. 9(3):133-6, 1996 Jun.

71. C. Finger W. Dreyer Jorgensen K. [Inhibition of polymerization by

oxygen in composite filling materials and enamel sealers]. [German] SSO: Schweizerische Monatsschrift fur Zahnheilkunde. 86(8):812-24, 1976 Aug.

References for laser etching

1. Vaarkamp J. ten Bosch JJ. Verdonschot EH. Propagation of light through human dental enamel and dentine. Caries Research. 29(1):8-13, 1995. Health Sciences Library (Boston).

2. Varma B. Tandon S. Enamel etching by carbon dioxide laser. An in-vitro comparative evaluation. Indian Journal of Dental Research. 8(1):19-25, 1997 Jan-Mar.

3. el-Karaksi AO. Influence of laser enamel and dentine etching on marginal integrity of porcelain laminate veneers. Egyptian Dental Journal. 41(2):1095-103, 1995 Apr.

4. Young A. Smistad G. Karlsen J. Rolla G. Rykke M. Zeta potentials of human enamel and hydroxyapatite as measured by the Coulter DELSA 440. Advances in Dental Research. 11(4):560-5, 1997 Nov. Health Sciences Library (Boston).

5. Sonju Clasen AB. Ogaard B. Duschner H. Ruben J. Arends J. Sonju T. Caries development in fluoridated and non-fluoridated deciduous and permanent enamel in situ examined by microradiography and confocal laser scanning microscopy. Advances in Dental Research. 11(4):442-7, 1997 Nov. Health Sciences Library (Boston).

6. Moritz A. Gutknecht N. Schoop U. Goharkhay K. Wernisch J. Sperr W. Alternatives in enamel conditioning: a comparison of conventional and innovative methods. Journal of Clinical Laser Medicine & Surgery. 14(3):133-6, 1996 Jun.

7. Ariyaratnam MT. Wilson MA. Mackie IC. Blinkhorn AS. A comparison of surface roughness and composite/enamel bond strength of human enamel following the application of the Nd:YAG laser and etching with phosphoric acid. Dental Materials. 13(1):51-5, 1997 Jan. Health Sciences Library (Boston).

8. Lian HJ. Lan WH. Lin CP. The effects of cooling systems on CO2-lased human enamel. Journal of Clinical Laser Medicine & Surgery. 14(6):381-4, 1996 Dec.

9. Duschner H. Gotz H. Ogaard B. Fluoride-induced precipitates on enamel surface and subsurface areas visualised by electron microscopy and confocal laser scanning microscopy. European Journal of Oral Sciences. 105(5 Pt 2):466-72, 1997 Oct. Health Sciences Library (Boston).

10. Hess JA. Subsurface morphologic changes of ND:YAG laser-etched enamel. Lasers in Surgery & Medicine. 21(2):193-7, 1997. Health Sciences Library (Boston).

11. Patel BC. Rickwood KR. Morphological changes induced by short pulse hydrogen fluoride laser radiation on dental hard tissue and restorative materials. Lasers in Surgery & Medicine. 21(1):1-6, 1997. Health Sciences Library (Boston).

12. Fried D. Glena RE. Featherstone JD. Seka W. Permanent and transient changes in the reflectance of CO2 laser-irradiated dental hard tissues at lambda = 9.3, 9.6, 10.3, and 10.6 microns and at fluences of 1-20 J/cm2. Lasers in Surgery & Medicine. 20(1):22-31, 1997. Health Sciences Library (Boston).

13. Wilder-Smith P. Lin S. Nguyen A. Liaw LH. Arrastia AM. Lee JP. Berns MW. Morphological effects of ArF excimer laser irradiation on enamel and dentin. Lasers in Surgery & Medicine. 20(2):142-8, 1997. Health Sciences Library (Boston).

14. Shahabi S. Brockhurst PJ. Walsh LJ. Effect of tooth-related factors on the shear bond strengths obtained with CO2 laser conditioning of enamel. Australian Dental Journal. 42(2):81-4, 1997 Apr. Health Sciences Library (Boston).

15. Angmar-Mansson B. al-Khateeb S. Tranaeus S. Monitoring the caries process. Optical methods for clinical diagnosis and quantification of enamel caries. European Journal of Oral Sciences. 104(4 (Pt 2)):480-5, 1996 Aug. Health Sciences Library (Boston).

16. Ogaard B. Duschner H. Ruben J. Arends J. Microradiography and confocal laser scanning microscopy applied to enamel lesions formed in vivo with and without fluoride varnish treatment. European Journal of Oral Sciences. 104(4 (Pt 1)):378-83, 1996 Aug. Health Sciences Library (Boston).

17. Odor TM. Watson TF. Pitt Ford TR. McDonald F. Pattern of transmission of laser light in teeth. International Endodontic Journal. 29(4):228-34, 1996 Jul. Health Sciences Library (Boston).

18. Frentzen M. Winkelstrater C. van Benthem H. Koort HJ. The effects of pulsed ultraviolet and infra-red lasers on dental enamel. European Journal of Prosthodontics & Restorative Dentistry. 4(3):99-104, 1996 Sep.

19. Westerman GH. Hicks MJ. Flaitz CM. Powell GL. Blankenau RJ. Surface morphology of sound enamel after argon laser irradiation: an in vitro scanning electron microscopic study. Journal of Clinical Pediatric Dentistry. 21(1):55-9, 1996 Fall. Health Sciences Library (Boston).

20. Zentner A. Duschner H. Structural changes of acid etched enamel examined under confocal laser scanning microscope. Journal of Orofacial Orthopedics. 57(4):202-9, 1996 Aug. 96345793

21. Mercer CE. Anderson P. X-ray microtomography: a novel technique for the quantification of effects in enamel following CO2 laser application. British Dental Journal. 180(12):451-5, 1996 Jun 22. Health Sciences Library (Boston).

22. Emami Z. al-Khateeb S. de Josselin de Jong E. Sundstrom F. Trollsas K. Angmar-Mansson B. Mineral loss in incipient caries lesions quantified with laser fluorescence and longitudinal microradiography. A methodologic study. Acta Odontologica Scandinavica. 54(1):8-13, 1996 Feb. Health Sciences Library (Boston).

23. Tagomori S. Iwase T. Ultrastructural change of enamel exposed to a normal pulsed Nd-YAG laser. Caries Research. 29(6):513-20, 1995. Health Sciences Library (Boston).

24. Stratmann U. Schaarschmidt K. Schurenberg M. Ehmer U. The effect of ArF-excimer laser irradiation of the human enamel surface on the bond strength of orthodontic appliances. Scanning Microscopy. 9(2):469-76; discussion 476-8, 1995 Jun.

25. Zijp JR. ten Bosch JJ. Groenhuis RA. HeNe-laser light scattering by human dental enamel. Journal of Dental Research. 74(12):1891-8, 1995 Dec. Health Sciences Lib

26. McCormack SM. Fried D. Featherstone JD. Glena RE. Seka W. Scanning electron microscope observations of CO_2 laser effects on dental enamel. Journal of Dental

27. Arrastia AM. Wilder-Smith P. Berns MW. Thermal effects of CO_2 laser on the pulpal chamber and enamel of human primary teeth: an in vitro investigation. Lasers in Surgery & Medicine. 16(4):343-50, 1995. Health Sciences Lib

28. Cernavin I. A comparison of the effects of Nd:YAG and Ho:YAG laser irradiation on dentine and enamel. Australian Dental Journal. 40(2):79-84, 1995 Apr. Health Sciences Library (Boston).

29. Seka W. Fried D. Featherstone JD. Borzillary SF. Light deposition in dental hard tissue and simulated thermal response. Journal of Dental Research. 74(4):1086-92, 1995 Apr. Health Sciences Library (Boston).

References for air abrasion

1. Awliya W. Oden A. Yaman P. Dennison JB. Razzoog ME. Shear bond strength of a resin cement to densely sintered high-purity alumina with various surface conditions. Acta Odontologica Scandinavica. 56(1):9-13, 1998 Feb. Health Sciences Library (Boston).

2. Mayes J. Porth R. Air abrasion: the new "drill-less" dentistry [interview by Phillip Bonner]. Dentistry Today. 16(9):58, 60, 62-5, 1997 Sep.

3. Feigenbaum N. Adhesives and air abrasion. [Review] [6 refs] Dentistry Today. 14(4):98, 100-1, 1995 Apr.

4. Zyskind D. Zyskind K. Hirschfeld Z. Fuks AB. Effect of etching on leakage

of sealants placed after air abrasion. Pediatric Dentistry. 20(1):25-7, 1998 Jan-Feb. Health Sciences Library (Boston).

5. Christensen GJ. Air abrasion tooth cutting: state of the art 1998. Journal of the American Dental Association. 129(4):484-5, 1998 Apr. Health Sciences Library (Boston).

6. Boston DW. Alperstein KS. Boberick K. Cavosurface margin geometry in conventional and air abrasion Class V cavity preparations. American Journal of Dentistry. 10(2):97-101, 1997 Apr.

7. Radz GM. Air abrasion: the future of restorative microdentistry. Compendium of Continuing Education in Dentistry. 18(6):534-8, 540, 1997 Jun. Health Sciences Library (Boston).

8. Olsen ME. Bishara SE. Damon P. Jakobsen JR. Comparison of shear bond strength and surface structure between conventional acid etching and air-abrasion of human enamel. American Journal of Orthodontics & Dentofacial Orthopedics. 112(5):502-6, 1997 Nov. Health Sciences Library (Boston).

9. Kanellis MJ. Warren JJ. Levy SM. Comparison of air abrasion versus acid etch sealant techniques: six-month retention. Pediatric Dentistry. 19(4):258-61, 1997 May-Jun. Health Sciences Library (Boston).

10. Willems G. Carels CE. Verbeke G. In vitro peel/shear bond strength evaluation of orthodontic bracket base design. Journal of Dentistry. 25(3-4):271-8, 1997 May-Jul. Health Sciences Library (Boston).

11. Kotlow LA. New technology in pediatric dentistry. New York State Dental Journal. 62(2):26-30, 1996 Feb. Health Sciences Library (Boston).

12. Kupiec KA. Barkmeier WW. Laboratory evaluation of surface treatments for composite repair. Operative Dentistry. 21(2):59-62, 1996 Mar-Apr. Health Sciences Library (Boston).

13. Sonis AL. Air abrasion of failed bonded metal brackets: a study of shear bond strength and surface characteristics as determined by scanning electron microscopy. American Journal of Orthodontics & Dentofacial Orthopedics. 110(1):96-8, 1996 Jul. Health Sciences Library (Boston).

14. Brown JR. Barkmeier WW. A comparison of six enamel treatment procedures for sealant bonding. Pediatric Dentistry. 18(1):29-31, 1996 Jan-Feb. Health Sciences Library (Boston).

15. Roeder LB. Berry EA 3rd. You C. Powers JM. Bond strength of composite to air-abraded enamel and dentin. Operative Dentistry. 20(5):186-90, 1995 Sep-Oct. Health Sciences Library (Boston).

16. Berry EA 3rd. Ward M. Bond strength of resin composite to air-abraded enamel. Quintessence International. 26(8):559-62, 1995 Aug. Health Sciences Library (Boston).

17. Laurell KA. Hess JA. Scanning electron micrographic effects of air-abrasion cavity preparation on human enamel and dentin. Quintessence International. 26(2):139-44, 1995 Feb. Health Sciences Library (Boston).

18. Los SA. Barkmeier WW. Effects of dentin air abrasion with aluminum oxide and hydroxyapatite on adhesive bond strength. Operative Dentistry. 19(5):169-75, 1994 Sep-Oct. Health Sciences Library (Boston).

19. Latta MA. Barkmeier WW. Bond strength of a resin cement to a cured composite inlay material. Journal of Prosthetic Dentistry. 72(2):189-93, 1994 Aug. Health Sciences Library (Boston).

20. Swift EJ Jr. Brodeur C. Cvitko E. Pires JA. Treatment of composite surfaces for indirect bonding. Dental Materials. 8(3):193-6, 1992 May. Health Sciences Library (Boston).

21. Huennekens SC. Daniel SJ. Bayne SC. Effects of air polishing on the abrasion of occlusal sealants. Quintessence International. 22(7):581-5, 1991 Jul. Health Sciences Library (Boston).

22. Ferrari M. Cagidiaco MC. Breschi R. Evaluation of resin-bonded retainers with the scanning electron microscope.Journal of Prosthetic Dentistry. 59(2):160-5, 1988 Feb. Health Sciences Library (Boston).

References for acid-etching

1. A. Buonocore MG. A simple method of increasing the adhesion of acrylic filling materials to enamel surfaces. J. Dent. Res 1955; 34:849-853.

2. B. Gwinnett AJ. Matsui A. A study of enamel adhesives. The physical relationship between enamel and adhesive. Arch. Oral Biol 1967; 12:1615-1620

3. C. Retief DH. Effect of conditioning the enamel surface with phosphoric acid. J. Dent. Res. 1973; 52:333-341

4. D. Gwinnett AJ. Histologic changes in human enamel following treatment with acidic adhesive conditioning agents. Arch Oral Biol 1971; 16:731-738

5. E. Silverstone LM, Saxton CA, Dogon IL, Fejerskov O. Variation in the pattern of acid etching of human dental enamel examined by scanning electron microscopy. Caries Res 1975; 9:373-387

6. F. Seow WK. Amaratunge A. The effects of acid-etching on enamel from

different clinical variants of amelogenesis imperfecta: an SEM study. Pediatric Dentistry. 20(1):37-42, 1998 Jan-Feb. Health Sciences Library (Boston).

7. Seow WK. Amaratunge A. The effects of acid-etching on enamel from different clinical variants of amelogenesis imperfecta: an SEM study. Pediatric Dentistry. 20(1):37-42, 1998 Jan-Feb. Health Sciences Library (Boston).

8. Zyskind D. Zyskind K. Hirschfeld Z. Fuks AB. Effect of etching on leakage of sealants placed after air abrasion. Pediatric Dentistry. 20(1):25-7, 1998 Jan-Feb. Health Sciences Library (Boston).

9. Moritz A. Gutknecht N. Schoop U. Goharkhay K. Wernisch J. Sperr W. Alternatives in enamel conditioning: a comparison of conventional and innovative methods. Journal of Clinical Laser Medicine & Surgery. 14(3):133-6, 1996 Jun.

10. Gunadi G. Nakabayashi N. Preparation of an effective light-cured bonding agent for orthodontic application. Dental Materials. 13(1):7-12, 1997 Jan. Health Sciences Library (Boston).

11. Ariyaratnam MT. Wilson MA. Mackie IC. Blinkhorn AS. A comparison of surface roughness and composite/enamel bond strength of human enamel following the application of the Nd:YAG laser and etching with phosphoric acid. Dental Materials. 13(1):51-5, 1997 Jan. Health Sciences Library (Boston).

12. Chan AR. Titley KC. Chernecky R. Smith DC. A short- and long-term shear bond strength study using acids of varying dilutions on bovine dentine. Journal of Dentistry. 25(2):145-52, 1997 Mar. Health Sciences Library (Boston).

13. Reisner KR. Levitt HL. Mante F. Enamel preparation for orthodontic bonding: a comparison between the use of a sandblaster and current techniques. American Journal of Orthodontics & Dentofacial Orthopedics. 111(4):366-73, 1997 Apr. Health Sciences Library (Boston).

14. Chung KH. Hwang YC. Bonding strengths of porcelain repair systems with various surface treatments. Journal of Prosthetic Dentistry. 78(3):267-74, 1997 Sep. Health Sciences Library (Boston).

15. Cagidiaco MC. Ferrari M. Vichi A. Davidson CL. Mapping of tubule and intertubule surface areas available for bonding in Class V and Class II preparations. Journal of Dentistry. 25(5):379-89, 1997 Sep. Health Sciences Library (Boston).

16. Kuhar M. Cevc P. Schara M. Funduk N. Enhanced permeability of acid-etched or ground dental enamel. Journal of Prosthetic Dentistry. 77(6):578-82, 1997 Jun. Health Sciences Library (Boston).

17. Hummel SK. Marker V. Pace L. Goldfogle M. Surface treatment of indirect resin composite surfaces before cementation. Journal of Prosthetic Dentistry. 77(6):568-72, 1997 Jun. Health Sciences Library (Boston).

18. Meredith N. Setchell DJ. In vitro measurement of cuspal strain and displacement in composite restored teeth. Journal of Dentistry. 25(3-4):331-7, 1997 May-Jul. Health Sciences Library (Boston).

19. Perdigao J. Lambrechts P. van Meerbeek B. Tome AR. Vanherle G. Lopes AB. Morphological field emission-SEM study of the effect of six phosphoric acid etching agents on human dentin. Dental Materials. 12(4):262-71, 1996 Jul. Health Sciences Library (Boston).

20. Cowan AJ. Wilson NH. Wilson MA. Watts DC. The application of ESEM in dental materials research. Journal of Dentistry. 24(5):375-7, 1996 Sep. Health Sciences Library (Boston).

21. Wong M. Eulenberger J. Schenk R. Hunziker E. Effect of surface topology on the osseointegration of implant materials in trabecular bone. Journal of Biomedical Materials Research. 29(12):1567-75, 1995 Dec. Health Sciences Library (Boston).

22. Uno S. Finger WJ. Phosphoric acid as a conditioning agent in the Gluma bonding system. American Journal of Dentistry. 8(5):236-41, 1995 Oct.

23. Goracci G. Mori G. Bazzucchi M. Marginal seal and biocompatibility of a fourth-generation bonding agent. DentalMaterials. 11(6):343-7, 1995 Nov. Health Sciences Library (Boston).

24. van Gogswaardt DC. Behrens VG. The effectiveness of an indicator gel in the detection of exposed dentine. Journal of Dentistry. 23(6):375-6, 1995 Dec. Health Sciences Library (Boston).

25. Richards A. Coote GE. Pearce EI. Proton probe and acid etching for determining fluoride profiles in porous porcine enamel. Journal of Dental Research. 73(3):644-51, 1994 Mar. Health Sciences Library (Boston).

26. Walsh LJ. Abood D. Brockhurst PJ. Bonding of resin composite to carbon dioxide laser-modified human enamel. Dental Materials. 10(3):162-6, 1994 May. Health Sciences Library (Boston).

27. Oikarinen KS. Nieminen TM. Influence of acid-etched splinting methods on discoloration of dental enamel in four media: an in vitro study. Scandinavian Journal of Dental Research. 102(6):313-8, 1994 Dec. Health Sciences Library (Boston).

28. Meechan JG. McCabe JF. Beynon AD. Adhesion of composite resin to

bone--a pilot study. British Journal of Oral & Maxillofacial Surgery. 32(2):91-3, 1994 Apr. Health Sciences Library (Boston).

29. Suliman AH. Swift EJ Jr. Perdigao J. Effects of surface treatment and bonding agents on bond strength of composite resin to porcelain. Journal of Prosthetic Dentistry. 70(2):118-20, 1993 Aug. Health Sciences Library (Boston).

30. Swift EJ Jr. Brodeur C. Cvitko E. Pires JA. Treatment of composite surfaces for indirect bonding. Dental Materials. 8(3):193-6, 1992 May. Health Sciences Library (Boston).

31. Yiu CK. Wei SH. Management of rampant caries in children. [Review] [47 refs] Quintessence International. 23(3):159-68, 1992 Mar. Health Sciences Library (Boston).

32. Smales RJ. Effects of enamel-bonding, type of restoration, patient age and operator on the longevity of an anterior composite resin. American Journal of Dentistry. 4(3):130-3, 1991 Jun.

33. Soderholm KJ. Roberts MJ. Variables influencing the repair strength of dental composites. Scandinavian Journal of Dental Research. 99(2):173-80, 1991 Apr. Health Sciences Library (Boston).

34. Hosoya Y. Goto G. Effects of cleaning, polishing pretreatments and acid etching times on unground primary enamel. Journal of Pedodontics. 14(2):84-92, 1990 Winter. Health Sciences Library (Boston).

35. Frentzen M. Koort HJ. Kermani O. Dardenne MU. [Preparation of hard tooth structure w ith Excimer lasers]. [German] Deutsche Zahnarztliche Zeitschrift. 44(6):454-7, 1989 Jun. Health Sciences Library (Boston).

36. Iijima Y. Koulourides T. Mineral density and fluoride content of in vitro remineralized lesions. Journal of Dental Research. 67(3):577-81, 1988 Mar. Health Sciences Library (Boston).

37. Ishikiriama A. Oliveira J de F. Vieira DF. Mondelli J. Influence of some factors on the fit of cemented crowns. Journal of Prosthetic Dentistry. 45(4):400-4, 1981 Apr. Health Sciences Library (Boston).

38. Vainio J. Kilpikari J. Tormala P. Rokkanen P. Experimental fixation of bone cement and composite resins to bone. Archives of Orthopaedic & Traumatic Surgery. 94(3):191-5, 1979 Aug.

39. Tsvetkova G. [Dental acid etching methods--theoretical premises and practical application]. [Review] [48 refs] [Bulgarian] Stomatologiia. 60(2):152-8, 1978 Mar-Apr.

40. Gwinnett AJ. Status report on acid etching procedures. Council on Dental Materials and Devices. Journal of the American Dental Association. 97(3):505-8, 1978 Sep. Health Sciences Library (Boston).

41. Koch G. Paulander J. [Clinical evaluation of composite restorations made with acid etching methods]. [Swedish] Svensk Tandlakaretidskrift. 69(6):191-6, 1976.

42. Rowe AH. A modification of the acid-etching technique for restoring fractured incisors. Journal of Dentistry. 2(1):35-6, 1973 Oct. Health Sciences Library (Boston).

Miscellaneous References

1. Lyons KM. Rodda JC. Hood JA. Use of a pressure chamber to compare microleakage of three luting agents. International Journal of Prosthodontics. 10(5):426-33, 1997 Sep-Oct.

2. Kydd WL. Nicholls JI. Harrington G. Freeman M. Marginal leakage of cast gold crowns luted with zinc phosphate cement: an in vivo study. Journal of Prosthetic Dentistry. 75(1):9-13, 1996 Jan. Health Sciences Library (Boston).

3. White SN. Yu Z. Tom JF. Sangsurasak S. In vivo microleakage of luting cements for cast crowns. Journal of Prosthetic Dentistry. 71(4):333-8, 1994 Apr. Health Sciences Library (Boston).

4. Prati C. Fava F. Di Gioia D. Selighini M. Pashley DH. Antibacterial effectiveness of dentin bonding systems. Dental Materials. 9(6):338-43, 1993 Nov. Health Sciences Library (Boston).

5. Blair KF. Koeppen RG. Schwartz RS. Davis RD. Microleakage associated with resin composite-cemented, cast glass ceramic restoration. International Journal of Prosthodontics. 6(6):579-84, 1993 Nov-Dec.

6. Zaimoglu A. Karaagaclioglu L. Uctasli. Influence of porcelain material and composite luting resin on microleakage of porcelain laminate veneers. Journal of Oral Rehabilitation. 19(4):319-27, 1992 Jul. Health Sciences Library (Boston).

7. White SN. Sorensen JA. Kang SK. Caputo AA. Microleakage of new crown and fixed partial denture luting agents. Journal of Prosthetic Dentistry. 67(2):156-61, 1992 Feb. Health Sciences Library (Boston).

8. Berg JH. Pettey DE. Hutchins MO. Microleakage of three luting agents used with stainless steel crowns. Pediatric Dentistry. 10(3):195-8, 1988 Sep. Health Sciences Library (Boston).

The following is a list of polymers which will be useful as a protective substance in the present invention.

POLYMER LIST

Tradenames, Generic Polymers, and Suppliers

Tradename	Material	Manufacturer
A		
Acctuf	PP copolymer	Amoco Polymers
Acetron	Acetal	DSM
Aclon	fluoropolymer	Allied Signal
ACP	PVC	Alpha Gary
Acrylite	acrylic	Cyro Industries
Acryrex	acrylic	Chi Mei Industrial
Adell	thermoplastic resin	Adell
Adflex	- - - -	Montell
Adpro	polypropylene	Huntsman
Adstif	- - - -	Montell
Affinity	plastomer	Dow Plastics
Aim	PS	Dow Plastics
Akulon	nylon 6,66	DSM
Akuloy	nylon 6,66 alloys	DSM
Alathon	HDPE, HDPE copolymer	Lyondell Polymers
Albis	nylon 6, 66	Albis Canada
Alcryn	TP elastomer	DuPont

Algoflon	fluoropolymer	Auismont
Alphatec	TP elastomer	Alpha Gary
Amilan	nylon	Toray Industries
Amoco	thermoplastic resin	Amoco
Amodel	PPA (polyphthalamide)	Amoco Polymers
Apec	PC (high temperature)	Bayer
API	polystyrene	American Polymers
Aqualoy	nylon 6/12, 66, PP	ComAlloy
Aquathene	polyethylene	Quantum
Alcryn	TP elastomer	DuPont
Arcel	styrene/ethylene copolymer	Nova Chemicals
Ardel	polyarylate	Amoco Polymers
Arnitel	TP elastomer	DSM
Aropol	thermoset resin	Ashland
Arpro	expandable PP bead	JSP
Arpak	expandable PP bead	JSP
Ashlene	nylon 6, 66, 6/12	Ashley Polymers
Astryn	PP alloy, co- and homopolymer, TPO	Montell
Attane	ULDPE	Dow Plastics
AurumTP	polyimide	Mitsui Toatsu
AVP	(various)	Polymerland
Azdel	thermoplastic resin	Azdel

B

Bapolene	polyethylene	Bamberger
Barex	acrylonitrile copolymer	BP Chemicals
Bayblend	polycarbonate/ABS	Bayer
Baydur	structural foam PUR RIM	Bayer
Baylon	nylon 6/6	Bay Resins
Beetle	urea formaldehyde	Cytec Industries
Benvic	PVC	Solvay
Beta	- - - -	Beta Polymers
Bexloy	ionomer	DuPont
Boltaron	FR PP	GenCorp
C		
Cabot	thermoplastic resin	Cabot
Cadon	SMA copolymer	Bayer
Calibre	polycarbonate	Dow Plastics
Capron	nylon 6, 66, 66/6	Allied Signal
Carilon	aliphatic PK	Shell
Cefor	polypropylene	Shell
Celanese	nylon 6, nylon 6/6	Hoechst-Celanese
Celanex	polyester (PBT)	Hoechst-Celanese
Celcon	acetal copolymer	Hoechst-Celanese
Celstran	long fiber reinforced	Hoechst-Celanese
Centrex	ASA, ASA+AES	Bayer
Cevian	ABS, ABS+PBT,SAN	Daicel

C-flex	SBS, SEBS	Concept Polymer
Chemigum	TP elastomer	Goodyear
Chemlon	Nylon 6,66	Chem Polymer
Claradex	ABS	Shin-A
Compodic	- - - -	DIC Trading
Comshield	PP	ComAlloy
Comtuf	impact resistant resins	ComAlloy
Cosmic	- - - -	Cosmic
Corton	mineral filled material	PolyPacific
Crastin	PBT	DuPont
Crystalor	polymethylpentene (PMP)	Phillips Chemical
CTI	Nylon 66	M.A.Hanna
Cycogel	ABS	Nova Polymers
Cycolac	ABS, ABS+PBT	GE Plastics
Cycolin	ABS/PBT	GE Plastics
Cycoloy	polycarbonate/ABS	GE Plastics
Cyglas	TS polyester	Cytec Industries
Cymel	melamine formaldehyde	Cytec Industries
Cyrex	acrylic/polycarbonate Alloy	Cyro Industries
Cyrolite	acrylic	Cyro Industries
D		
Delrin	acetal	DuPont
Desmopan	TP polyurethane	Bayer

Dexplex	TPO	D&S Polymers
Diamon	- - - -	Diamond Polymers
Dimension	Nylon 6 alloy	Allied Signal
Dowlex	HDPE, LLDPE	Dow Plastics
Drexflex	TP elastomer	D&S Plastics
Duraflex	polybutylene	Shell
Dural	PVC	Alpha Gary
Durel	polyarylate	Hoechst-Celanese
Durethan	nylon 6	Bayer
Durez	thermoset resins	Occidental
Dylark	SMA copolymer	Nova Chemicals
Dylene	polystyrene	Nova Chemicals
Dylite	expandable polystyrene	Nova Chemicals
Dynaflex	SBS, SEBS	GLS Plastics
E		
Eastabond	PET	Eastman Chemical
Eastalloy	PC+Polyester	Eastman Chemical
Eastapak	PET	Eastman Chemical
Eastar	(various polyesters)	Eastman Chemical
Eastman	thermoplastic resin	Eastman Chemical
Ecdel	TP elastomer	Eastman Chemical
Ecoprene	TP Elastomer	Rubber & Plastics Solutions
Edistir	polystyrene	Enichem

Ektar	PET, PBT, PCT polyester	Eastman Chemical
Ektar FB	TP elastomer	Eastman Chemical
Elastalloy	TP elastomer	GLS corp
Elastollan	polyurethane TPE	BASF
Electrafil	electrically conductive polymers	DSM
Elexar	TP Elastomer	Teknor Apex
Elvamide	nylon copolymer	DuPont
Eltex	HDPE	Solvay
Eltex P	PP	Solvay
Elvax	EVA copolymer	DuPont
Emac	EMA copolymer	Chevron Chemical
Emiclear	- - - -	Toshiba
Emi-X	(various)	LNP
Empee	polyethylene, polypropylene	Monmouth
Enathene	ethylene butyl acrylate	Quantum
Engage	TP elastomer	Dow Plastics
Epalex	- - - -	PolyPacific
Eref	PA/PP alloy	Solvay
Escalloy	PP (stress crack resist)	ComAlloy
Escoracid	terpolymer	Exxon Chemical
Escorene	polypropylene	Exxon Chemical
Estaloc	polyurethane	BF Goodrich
Estane	polyurethane TPEBF	Goodrich

Evalca	EVA copolymer	Eval
Exact	plastomer	Exxon Chemical
Extron	glass filled material	PolyPacific
Exxtral	TP elastomer	Exxon Chemical
F		
Faradex	conductive wire filled	DSM
Ferrene	polyethylene	Ferro
Ferrex	polypropylene	Ferro
Ferro	- - - -	Ferro
Ferrocon	Polyolefin	Ferro
Ferroflo	polystyrene	Ferro
Ferropak	PP/PE alloy	Ferro
Fiberfil	fiber reinforced material	DSM
Fiberloc	fiber reinforced PVC	Geon
Fiberstran	long fiber reinforced material	DSM
Fina	polyolefin	Fina Oil
Finaclear	polystyrene, SBS	Fina Oil
Finaprene	TP elastomer	Fina Oil
Flexalloy	PVC	Teknor Apex
Flexomer	polyethylene (ULDPE)	Union Carbide
Flexprene	TP elastomer	Teknor Apex
Fluorocomp	reinforced fluoropolymer	LNP
Foamspan	thermoplastic foam	ComAlloy

Foraflon	PVDF	Atochem
Formion	ionomer	A. Schulman
Fortiflex	polyethylene	Solvay
Fortilene	polypropylene	Solvay
Fortron	PPS	Hoechst-Celanese
FR-P	CPC	Lucky
FTPE	Fluorelastomer	3M Performance Polymers
G		
Gapex	nylon	Ferro
Geloy	ASA, ASA+PC, ASA+PVC	GE Plastics
Geolast	TP elastomer	Advanced Elastomer Sys.
Geon	PVC	Geon
Glaskyd	alkyd	CYTEC
Glastic	thermost resin	Glastic
Goldrex	acrylic	Hanyang Chemical
Grilamid	nylon 12	EMS-American Grilon
Grilon	nylon 6, 66	EMS-American Grilon
Grilpet	PET	EMS-American Grilon
Grivory	nylon	EMS-American Grilon
H		
Halar	fluoropolymer	Ausimont

Halon	fluoropolymer	Ausimont
Hanalac	ABS	Miwon
Haysite	thermoset resin	Haysite
Hercuprene	TP elastomer	J-Von
Hetron	thermoset resin	Ashland
Hifax	PP, TPE, TPO	Montell
HiGlass	glass filled polypropylene	Himont
Hiloy	high strength resin	ComAlloy
Histat	electrically conductive	United Composites
HiVal	polyethylene (HDPE)	General Polymers
Hivalloy	PP alloy	Montell
Hostacen	metallocene PP	Hoechst-Celanese
Hostacom	reinforced PP	Hoechst-Celanese
Hostaflon	fluoropolymers	Hoechst-Celanese
Hostaform	acetal copolymer	Hoechst-Celanese
Hostalen	PE	Hoechst-Celanese
Hostalen-GUR	UHMW PE	Hoechst-Celanese
Hostalen PP	polypropylene	Hoechst-Celanese
Hostalloy	polyolefin alloy	Hoechst-Celanese
Huntsman	thermoplastic	Huntsman
Hyflon	fluoropolymer	Auismont
Hylar	PVDF	Auismont
Hylon	nylon 6, 66	Hale
Hytrel	TP elastomer	DuPont

I

Impetpolyester	(PET)	Hoechst-Celanese
Interpol	polyurethane	Cook Composites
Iotek	ionomer	Exxon
Isoplast	TPU	Dow Plastics
Iupiace	PPO/PPE	Mitsubishi
Iupilon	polycarbonate	Mitsubishi
Iupital	acetal	Mitsubishi
Ixan	PVDF	Solvay
Ixef	polyarylamide	Solvay Polymers

J

J-Plast	TP elastomer	J-Von

K

Kadel	PAEK	Amoco Polymers
Kamax	acrylic copolymer	AtoHaas
Kemcor	LDPE, HDPE	Kemcor Australia
Kematal	acetal copolymer	Hoechst-Celanese
Kibisan	SAN	Chi Mei Industrial
Kibiton	SBS	Chi Mei Industrial
Koblend	polycarbonate/ABS	EniChem America
Kodapak	PET polyester	Eastman
Kodar	PETG polyester	Eastman
Kohinor	vinyl	Rimtec
Kopa	Nylon 6,66	Kolon America

Kraton	styrenic TPE	Shell Chemical
K-Resin copolymer	styrene/butadiene	Phillips Chemical
Kynar	PVDF	Atochem
L		
Ladene	polystyrene	SABIC
Lexan	polycarbonate	GE Plastics
Lomod	TP elastomer	GE Plastics
Lubricomp	wear resistant material	LNP
Lubrilon	nylon 6,66,6/12,PBT	Comalloy
Lubriloy	internally lubricated material	LNP
Lucel	acetal copolymer	Lucky
Lucet	acetal copolymer	Lucky
Lumax	PBT alloy	Lucky
Lupan	SAN	Lucky
Lupol	polyolefin	Lucky
Lupon	nylon 66	Lucky
Lupos	ABS	Lucky
Lupox	PBT	Lucky
Lupoy	ABS+PBT	Lucky
Luran	SAN,ASA	BASF
Lusep	PPS	Lucky
Lustran	ABS, SAN, ABS+Acrylic	Bayer
Luxis	nylon 6/6	Westover

Lytex	epoxy	Quantum Composites
M		
Magnacomp	Nylon 6, 6/10, PP	LNP
Magnum	ABS	Dow Plastics
Makrolon	polycarbonate, PC blend	Bayer
Makroblend	polycarbonate blend	Bayer
Malecca	styrenic copolymer	Denki Kagaku
Maranyl	nylon	ICI Americas
Marlex	polyethylene, polypropylene	Phillips Chemical
Mater-Bi	biodegradeable polymer	Novamont
Microthene	PE	Quantum
Milastomer	TP elastomer	Mitsui
Mindel	PSU, PSU alloy	Amoco Polymers
Minlon	mineral filled nylon 6/6, 6/6/6	DuPont
Morthane	TPU	Morton
Multibase	ABS	Multibase
Multi-Flam	polypropylene	Multibase
Multi-Flex	TP elastomer	Multibase
Multi-Hips	polystyrene	Multibase
Multi-Pro	polypropylene	Multibase
Multi-San	SAN copolymer	Multibase
N		
NASSMMA	acrylic	Nova Chemicals

Naxell	polycarbonate (recycled)	MRC Polymers
Norsophen	Phenolic	Norold Composites
Nortuff	HDPE, polypropylene	Polymerland
Noryl	PPO, PPO alloy	GE Plastics
Novalast	TP elastomer	Nova Polymers
Novalene	TP elastomer	Nova Polymers
Novamid	nylon	Mitsubishi
Novapol	LLDPE,LDPE,HDPE	Nova Chemicals
Novatemp	PVC	Novatec
Novon	starch based polymer	Novon
NSC	Nylon, PS	Thermofil
Nucrel	EMAA copolymer	DuPont
Nybex	nylon 6/12	Nova
Nydur	nylon 6	Bayer (now called Durethan)
Nylafil	nylon 66	DSM
Nylamid	nylon	Polymer Service
Nylast	TP elastomer	Allied Signal
Nylatron	glass reinforced nylon	DSM
Nylene	nylon	Custom Resins
Nylind	nylon 66	DuPont
Nyloy	nylon 66, PC, PP	Nytex Composites
Nypel	nylon 6	Allied SIgnal
Nytron	nylon 66	Nytex Composites

O

Olehard	filled polypropylene	Chiso America
Ontex	TP elastomer	D&S Plastics
Optema	EMA copolymer	Exxon Chemical
Optix	acrylic	Plaskolite
Oxy	vinyl	Occidental
Oxyblend	vinyl	Occidental
Oxyclear	PVC	Occidental

P

Panlite	polycarbonate	Teijin Chemical
Paxon	HDPE	Paxon
Pebax	PEBA	Atochem
Pellethane	polyurethane TP elastomer	Dow Plastics
PermaStat	(various)	RTP
Perspex	acrylic	ICI Acrylics
Petlon	PBT	Albis
Petra	polyester (PET)	Allied Signal
Petrothene	polyethylene, polypropylene, TPO	Quantum
Pibiter	polyester (PBT)	EniChem
Plaslok	thermoset resins	Plaslok
Plaslube	lubricated materials	DSM
Plenco	thermoset resins	Plastics Engineering

Plexiglas	acrylic	AtoHaas (Rohm & Haas)
Pliovic	vinyl	Goodyear
PMC	melamine formaldehyde	Sun Coast
Pocan	polyester (PBT)	Albis
Polifil	reinforced polyolefins	Polifil
Polyfabs	ABS	A. Schulman
Polyfil	- - - -	Polyfil
Polyfine	- - - -	Tokutama Soda
Polyflam	flame retardant thermoplastic	A. Schulman
Polyflon	fluoropolymer	Daikin
Polyfort	polypropylene, polyethylene	A. Schulman
Polylac	ABS	Chi Mei Industrial
Polyman	ABS Alloy	A. Schulman
Polypur	reinforced or alloyed TPE	A. Schulman
Polytron	PVC alloy	Geon
Polytrope	TP elastomer	A. Schulman
Polyvin	PVC	A. Schulman
Porene	ABS	Thai Petrochemical
Premi-glas	glass reinforced SMC	Premix
Premi-ject	thick molding compound (thermoset)	Premix
Prevail	ABS/polyurethane	Dow Plastics
Prevex	PPE	GE Plastics

Primef	PPS	Solvay
Prism	polyurethane RIM	Bayer
Polyvin	PVC	A. Schulman
Primacor	EAA copolymer	Dow Plastics
Pro-Fax	polyolefins	Montell
Propak	polypropylene	PolyPacific
Pulse	polycarbonate/ABS	Dow Plastics
R		
RTP	- - - -	RTP
Radel	polyether sulfone	Amoco Performance Products
Radiflam	nylon FR	Radicinovacips
Radilon	nylon 6	Radicinovacips
Radipol	nylon 6/6	Radicinovacips
Reny	nylon 6/6	Mitsubishi
Replay	polystyrene	Huntsman
Reprean	ethylene copolymer	Discas
Resinoid	thermoset resins	Resinoid
Retain	PE	Dow Plastics
Rexene	thermoplastic resin	Rexene
Rexflex	polypropylene	Rexene
Rilsan	rotational molding resins	Atochem
Rimplast	TP elastomer	Huls
Rimtec	vinyl	Rimtec

Riteflex	TP elastomer	Hoechst-Celanese
Rogers	thermoset resins	Rogers
Ronfalin	ABS	DSM
Rynite	polyester (PET,PBT)	DuPont
Ryton	PPS	Phillips Chemical
S		
Sabre	PC+PET	Dow Plastics
Santoprene	TPE, TPO	Advanced Elastomer Sys.
Saran	vinylidine chloride	Dow Plastics
Sarlink	TPE, TPO	DSM
Satinflex	PVC	Alpha Gary
Schulaflex	flexible elastomers	A. Schulman
Schulamid	nylon 6, 66	A. Schulman
Schulink	cross-linkable HDPE	A. Schulman
Sclair	polyethylene	Nova Chemicals
Selar	nylon, PET	DuPont
Shell	polyolefins	Shell
Shinite	PBT	Shinkong
Sinkral	ABS	EniChem
Sinvet	polycarbonate	EniChem
Soarnol	EVA copolymer	Nichimen
Solef	PVDF	Solvay Polymers
Solvic	PVC	Solvay Polymers

Spectar	polyester copolymer	Eastman
Stanyl	nylon 46	DSM
Stanuloy	PC.PET blend (recycled)	MRC Polymers
Stapron	ABS+PC, SMA	DSM
Stat-Kon	static dissipative material	LNP
Stat-Loy	static dissipative material	LNP
Stereon	styrene/butadiene bl. copolymer	Firestone
Stypol	thermoset resin	Cook Composites
Styrafil	filled styrenes	DSM
Styron	PS	Dow Plastics
Styropor	PS	BASF
Sumiplex	acrylic	Sumitomo
Sunprene	PVC elastomer	A. Schulman
Suntra	PPS	Sunkyong Industries
Supec	PPS	GE Plastics
Superkleen	PVC	Alpha Gary
Suprel	ABS/PVC	Vista Chemical
Surlyn	Ionomer	DuPont
Synprene	TP elastomer	Synergistics Industries
T		
Technyl	nylon 66	Rhone-Poulenc
Tecoflex	PUR	Thermidics

Tecothane	PUR	Thermidics
Tedur	PPS	Albis
Teflon	fluoropolymer	DuPont
Tefzel	PE-TFE	fluoropolymerDuPont
Tekron	TP elastomer	Teknor Apex
Telcar	TP elastomer	Teknor Apex
Telcar	TP elastomer	Teknor Apex
Tempalloy	high temperature resin	ComAlloy
TempRite	CPVCBF	Goodrich
Tenac	acetal	Ashai
Tenite	polyolefin, cellulosic, CAB	Eastman
Terluran	ABS	BASF
Terlux	MABS	BASF
Texalon	nylon	Texapol
Texapol	- - - -	Texapol
Texin	polyurethane	Bayer
Thermex	heat dissipative materials	ComAlloy
Thermocomp	glass, carbon fiber reinforced	LNP
Thermx	copolyester	Eastman
Tone	PCL	Union Carbide
Tonen	- - - -	TCA Plastics
Topalloy	- - - -	TCA Plastics
Topas	cycloolefin copolymer	Hoechst-Celanese

Topex	PBT	Tong Yang Nylon
Toplex	polycarbonate/ABS	Multibase
Toray	PBT	Toray Industries
Torlon	polyamide-imide	Amoco Polymers
Toyolac	ABS, polycarbonate /ABS	Toray Industries
TPX	polymethylpentene (PMP)	Mitsui
Trefsin	TP elastomer	Advanced Elastomer Sys.
Triax	polycarbonate/ABS, ANS/Nylon	Bayer
Tribit	PBT	Sam Yang
Triloy	PC+PBT, ABS+PC	Sam Yang
Trirex	PC	Sam Yang
Tufrex	ABS	Bayer
Typlax	- - - -	Typlax
Tyril	SAN	Dow Plastics
U		
Ube	- - - -	Ube Industries
Udel	PSO	Amoco Performance Products
Ultem	polyetherimide	GE Plastics
Ultradur	polyester (PBT)	BASF
Ultraform	acetal	BASF
Ultramid	nylon	BASF
Ultrapek	PAEK	BASF

		Industries
T		
Technyl	nylon 66	Rhone-Poulenc
Tecoflex	PUR	Thermidics
Tecothane	PUR	Thermidics
Tedur	PPS	Albis
Teflon	fluoropolymer	DuPont
Tefzel	PE-TFE	fluoropolymerDuPont
Tekron	TP elastomer	Teknor Apex
Telcar	TP elastomer	Teknor Apex
Telcar	TP elastomer	Teknor Apex
Tempalloy	high temperature resin	ComAlloy
TempRite	CPVCBF	Goodrich
Tenac	acetal	Ashai
Tenite	polyolefin, cellulosic, CAB	Eastman
Terluran	ABS	BASF
Terlux	MABS	BASF
Texalon	nylon	Texapol
Texapol	- - - -	Texapol
Texin	polyurethane	Bayer
Thermex	heat dissipative materials	ComAlloy
Thermocomp	glass, carbon fiber reinforced	LNP

Thermx	copolyester	Eastman
Tone	PCL	Union Carbide
Tonen	- - - -	TCA Plastics
Topalloy	- - - -	TCA Plastics
Topas	cycloolefin copolymer	Hoechst-Celanese
Topex	PBT	Tong Yang Nylon
Toplex	polycarbonate/ABS	Multibase
Toray	PBT	Toray Industries
Torlon	polyamide-imide	Amoco Polymers
Toyolac	ABS, polycarbonate /ABS	Toray Industries
TPX	polymethylpentene (PMP)	Mitsui
Trefsin	TP elastomer	Advanced Elastomer Sys.
Triax	polycarbonate/ABS, ANS/Nylon	Bayer
Tribit	PBT	Sam Yang
Triloy	PC+PBT, ABS+PC	Sam Yang
Trirex	PC	Sam Yang
Tufrex	ABS	Bayer
Typlax	- - - -	Typlax
Tyril	SAN	Dow Plastics
U		
Ube	- - - -	Ube Industries

Udel	PSO	Amoco Performance Products
Ultem	polyetherimide	GE Plastics
Ultradur	polyester (PBT)	BASF
Ultraform	acetal	BASF
Ultramid	nylon	BASF
Ultrapek	PAEK	BASF
Ultrason - E	polyether sulfone (PES)	BASF
Ultrason - S	polysulfone (PSO)	BASF
Ultrastyr	ABS	Enichem America
Ultrathene	EVA copolymer	Quantum
Unichem	PVC	Colorite Plastics
Unival	polyethylene	Union Carbide
V		
Valox	polyester (PBT, PET, PCT)	GE Plastics
Valtec	- - - -	Montell
Valtra	polystyrene	Chevron Chemical
Vandar	polyester alloy	Hoechst-Celanese
Vector	SBS, SIS	Dexco Polymers
Vectra	liquid crystal polymer	Hoechst-Celanese
Verton	long fiber reinforced	LNP
Vespel	polyimide	DuPont
Vestamid	nylon	Huls

Victrex	PEEKICI	Advanced Materials
Vista	vinyl	Vista Chemical
VistaFlex	TP elastomer	Advanced Elastomer Sys.
Vistel	PVC	Vista Chemical
Vitax	ASA	Hitachi Chemical
Voloy	flame retardant materials	ComAlloy
Vybex	polyester	Ferro
Vydyne	nylon	Monsanto
Vyram	TP elastomer	Advanced Elastomer Sys.
Vythene	PVC+PUR	Alpha Gary
W		
Wellamid	nylon	Wellman
WPP	PP	Washington Penn
X		
Xenoy	polycarbonate/polyester	GE Plastics
XT-Polymer	acrylic copolymer	Cyro Industries
Xydar	liquid crystal polymer	Amoco Polymers
Z		
Zemid	PE, HDPE	DuPont Canada
Zenite	LCP	DuPont
Zeonex	polymethylpentene (PMP)	Nippon Zeon

Zylar	acrylic copolymer	Novacor
Zytel	nylon	DuPont

The present invention has been described in detail, including the preferred embodiments thereof. However, it will be appreciated that those skilled in the art, upon consideration of the present disclosure, may make modifications and/or improvements on this invention and still be within the scope and spirit of this invention as set forth in the following claims.

WHAT IS CLAIMED IS:

1. A method of protecting teeth from decay comprising the steps of:

a. etching the teeth;

b. applying one or more protective substances to the etched teeth; and

c. sealing the protected teeth.

2. A method of protecting teeth from decay comprising the steps of:

a. etching the teeth; and

b. applying one or more self-sealing protective substances to the etched teeth.

3. The method of claims 1 or 2, wherein the protective substance further includes at least one colorant material for changing the color of the teeth.

4. The method of Claim 1 or 2, wherein the protective substance comprises a polymer material.

5. The method of Claim 1 or 2, wherein the protective substance comprises a ceramic material.

6. A method of protecting teeth from decay comprising the steps of:

a. the dental tissue is etched and dried;

b. a protective polymer or ceramic material is applied to the etched dental tissue; and

c. a laser beam or flame is used to melt the protective material into each tooth.

AMENDED CLAIMS

[received by the International Bureau on 9 December 1999 (09.12.99); original claims 1-6 replaced by new claims 1-7 (1 page)]

1. A method of protecting a tooth from decay, restoring a tooth or painting a tooth, comprising the steps of:

a. etching at least one section of said tooth;
b. drying said etched tooth;
c. coating said etched and dried tooth sections with one or more protective and/or restorative preformed polymeric or non-hydroxyapatite ceramic substances, wherein said substances may also contain a colorant material; and,
d. sealing said etched, dried and coated tooth.

2. The method of claim 1, wherein said preformed polymeric substance is a thermoplastic.

3. The method of claim 1, wherein said coating substance is in the form of a powder.

4. The method of claim 1, wherein said coating is applied by spraying or electrophoresis.

5. The method of claim 1, wherein said sealing is produced by a heat source.

6. The method of claim 4, wherein said heat source is selected from the group consisting of a laser, a flame and a hot air stream.

7. The method of claim 1, wherein said coating is self-sealing.

STATEMENT UNDER ARTICLE 19 (1)

The elements in substitute claim 1 that distinguish over the Ferrace reference are: (i) the claimed invention uses a *preformed* polymeric coating (Ferrace produces a polymer *only in situ*; and (ii) the claimed invention has an option of a colorant in the coating, whereas Ferrace does not mention coloring.

The elements in substitute claim 1 that distinguishe over the Stewart reference are: (i) the claimed invention specifically excludes hydroxyapatite, whereas Stewart's coating is limited to hydroxyapatite; and (ii) Stewart also does not mention a colorant.

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US99/17879

A. CLASSIFICATION OF SUBJECT MATTER

IPC(6) : A61C 5/00
US CL : 433/217.1
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

U.S. : 433/217.1

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	FERRACE, Jack L., Materials in Dentistry, Principles and Applications, J. B. Lippincott Company, Copyright 1995, pages 40-50.	1-5
X	US 4,224,072 A (STEWART) 23 September 1980, Abstract.	6

☐ Further documents are listed in the continuation of Box C. ☐ See patent family annex.

* Special categories of cited documents:

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
22 SEPTEMBER 1999	22 OCT 1999

Name and mailing address of the ISA/US	Authorized officer
Commissioner of Patents and Trademarks Box PCT Washington, D.C. 20231	RALPH LEWIS
Facsimile No. (703) 305-3230	Telephone No. (703) 308-0770