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(54) **Titre : COMPOSITIONS DE VERNI DENTAIRE RENFERMANT DE LA COLOPHANE, DE LA RESINE ET UN AGENT
FLUORISANT**

(54) **Title: DENTAL VARNISH COMPOSITIONS COMPRISING ROSIN, RESIN, AND A FLUORIDIZING AGENT**

(57) **Abrégé/Abstract:**

The invention provided herein relates to dental varnishes comprising rosin, resin, a fluoridizing agent, a solvent, an optional remineralization agent, an optional flavor additive, an optional sweetener, and optionally an oxide. In an embodiment, dental varnishes provided herein demonstrate improved fluoride release and improved transmittance of light.



64053-652

ABSTRACT

The invention provided herein relates to dental varnishes comprising rosin, resin, a fluoridizing agent, a solvent, an optional remineralization agent, an optional flavor additive, an optional sweetener, and optionally an oxide. In an embodiment, dental
5 varnishes provided herein demonstrate improved fluoride release and improved transmittance of light.

64053-652

DENTAL VARNISH COMPOSITIONS COMPRISING ROSIN, RESIN, AND A FLUORIDIZING AGENT

[001] This Application claims priority from U.S. Provisional Application No. 61/765,062, filed February 15, 2013.

5 BACKGROUND

[002] Dental varnishes known in the art are generally comprised of natural gum rosin, sodium fluoride, and various solvents, flavor additives, sweetener and pigments. Such dental varnishes are normally applied by a brush onto a tooth surface to prevent tooth decay via a fluoride release from the composition. One of issues with
10 the well know dental varnishes is that the fluoride release tends to be slow, i.e., more than 4 hours. This slow fluoride release results from gum rosins being used as carriers. The gum rosins used in known dental varnishes are hydrophobic and do not dissolve in saliva.

[003] Therefore, it generally requires at least six hours of treatment time to be able to
15 release enough fluoride ion. Another issue of traditional varnishes that most varnishes are yellow, and patients generally prefer not to draw attention to their fluoride varnished teeth. The color present in traditional varnish is caused by the dark color of natural gum rosins.

BRIEF DESCRIPTION OF THE FIGURES

20 [003a] Fig. 1 is a bar graph of Delta E before and after varnish coating.

DETAILED DESCRIPTION

[004] Disclosed herein is a dental varnish demonstrating improved fluoride release and improved transmittance of light. The dental varnish described herein is comprised of rosin, resin, a fluoridizing agent, a solvent, an optional remineralization
25 agent, an optional flavor additive, an optional sweetener and optionally an oxide.

64053-652

[004a] In an embodiment, there is provided a dental varnish comprising a rosin, a vinyl type resin, a fluoridizing agent, a solvent, an optional remineralization agent, an optional flavor additive, an optional sweetener and optionally an oxide.

[004b] In an embodiment, there is provided a dental varnish comprising a rosin,
5 resin, a fluoridizing agent, a solvent, an optional remineralization agent, an optional
flavor additive, an optional sweetener and optionally an oxide, wherein the dental
varnish is transparent, exhibiting a transmittance of at least 50%, wherein the rosin is
present in the dental varnish from about 18 to about 60 percent by weight and
wherein the resin is a reaction product of 2,2' bis[p-(2'-hydroxy-3'
10 methacryloxypropoxy)phenyl]propane (BisGMA) and hexamethylene diisocyanate
(HMDI) and is present in the dental varnish from about 25 to about 60 percent by
weight.

[004c] In an embodiment, there is provided a one-part dental varnish comprising a
solution of a rosin and a non-rosin resin in a common solvent and further comprising
15 a fluoridizing agent, wherein the dental varnish is transparent, exhibiting a
transmittance of at least 50%, the rosin is present in the dental varnish from about 18
to about 60 percent by weight and the resin is present in the dental varnish from
about 25 to about 60 percent by weight.

[004d] In an embodiment, there is provided a one-part dental varnish comprising a
20 solution of a fully hydrogenated rosin and a colorless non-rosin resin in a common
solvent and further comprising a fluoridizing agent, wherein the dental varnish is a
clear, transparent dental varnish, the rosin is present as about 18 to about 60 percent
by weight of the varnish, the resin is present as about 25 to about 60 percent by
weight of the varnish, and the fluoridizing agent is present as about 0.1 to about 8
25 percent by weight of the varnish.

Rosin

[005] In embodiments, rosins suitable for use herein include FORAL™ AX-E
(hydrogenated gum rosin; acid number (AN) 165), STAYBELITE™ Resin-E (partially

64053-652

hydrogenated gum rosin; AN 162), PAMITE™ 79 (tall oil rosin; AN 164), PAMITE™ 79-1 (tall oil rosin; AN 158), PAMITE™ 90 (tall oil rosin; AN 175), POLY-PALE™ (partially dimerized rosin; AN 142), DYMEREX™ (dimerized rosin; AN 140), POLYSTIX™ 90 (partially dimerized rosin; AN 150), DRESINATE™ (rosin soap), and
5 PERMALYN™ NC-11 (noncrystalline rosin; AN 157), all of which are available from Eastman Chemical Company.

[006] Further examples of rosins suitable for use herein may be any of the commercially available types of rosin such as wood rosin, gum rosin, tall oil rosin, and mixtures thereof in their crude or refined state. The methyl ester of hydrogenated rosin, the triethylene glycol ester of hydrogenated rosin, the diethylene glycol ester of hydrogenated rosin, the ethylene glycol ester of hydrogenated rosin, and mixtures thereof with each other or with the glycerol ester of hydrogenated (partially or substantially completely) rosin are also suitable for use herein.

[007] The rosin suitable for use herein is at least a partially hydrogenated rosin, such as a fully hydrogenated rosin. The more hydrogenated that a rosin, the more colorless it will appear to the human eye. This is because the double bonds found in rosins tend to absorb color, thus appear to have a color to the human eye. However, when the rosins are hydrogenated, less color will be absorbed thus appearing to be colorless. The rosin is necessary to the dental varnish described herein because the rosin provides the adhesion of the varnish to the tooth of a patient. Without the rosin, a dental varnish would not stick to or adhere to the teeth upon application of the varnish.

[008] The rosin may be present in the dental varnish in amounts of from about 5 weight percent to about 75 weight percent, such as from about 18 weight percent to about 60 weight percent or from about 29 weight percent to about 35 weight percent.

Resin

[009] The resin suitable for use in the dental varnish described herein include vinyl type resins, such as acrylic type resins, styrene type resins and the like. Examples of such vinyl monomers are 4-methacryloxyethyl trimellitic acid and its anhydride, bisphenol type epoxy acrylates and their oligomers, urethane dimethacrylates, methyl acrylate, methyl methacrylate, ethyl methacrylate, butyl methacrylate, polyethyleneglycol dimethacrylates, 2,2-bis(p-2'-hydroxy-3'-methacryloxy propoxyphenyl) propane, 2,2-bis(4-methacryloxy polyethoxy phenyl) propane, acrylonitril, vinyl acetate, 2-cyano acrylic acid esters, styrene and divinyl benzene. These vinyl monomers can be employed alone or in any mixture thereof.

[0010] The resin may be present in the dental varnish in amounts of from about 20 weight percent to about 75 weight percent, such as from about 25 weight percent to about 60 weight percent or from about 35 weight percent to about 45 weight percent.

[0011] In one embodiment, the resin may be synthesized by a reaction between 2, 2' bis[p-(2'-hydroxy – 3' methacryloxypropoxy)phenyl]propane (BisGMA) (about 75-95 wt. %) and hexamethylene diisocyanate (HMDI) (about 5-25 wt. %) at a temperature of from about 40°C to about 60°C for from about 6 to about

64053-652

8 hours in a mixer at a mixing speed of from about 10 rpm to about 35 rpm. Dabco T-9TM (about 0.01-0.1 wt. %) may be used as a catalyst and butylated hydroxy toluene (BHT) (about 0.01 to 0.1 wt. %) may be used as a stabilizer. This synthesized resin is especially useful as it is a substantially colorless resin. This synthesized resin in combination with a hydrogenated rosin provides for a colorless dental varnish as both the resin and the rosin are substantially colorless. As one of ordinary skill in the art will understand, any resin that is substantially colorless is suitable for use in the dental varnish described herein.

Fluoridizing Agent

[0012] In embodiments, fluoridizing agents suitable for use in the dental varnish described herein include include sodium fluoride, stannous fluoride, sodium monofluorophosphate, zinc hexafluorosilicate, and sodium hexafluorosilicate. The fluoridizing agent may be present in the dental varnish in amounts of from about 0.1 weight percent to about 8 weight percent, such as from about 1 weight percent to about 7.5 weight percent or from about 2 weight percent to about 7 weight percent.

Solvent

[0013] Solvents suitable for use in the dental varnish described herein include one or more alcohols, one or more hydrocarbons or combinations therein. In some embodiments, the solvent comprises a mixture of alcohol and hydrocarbons at azeotropic or near azeotropic proportions. The relative weights given above relate only to azeotropic mixtures, and are not intended to restrict the absolute or relative amounts of alcohol and/or hydrocarbon in the dental varnish formulations. Dental varnish formulations may include individual solvents (e.g. ethyl alcohol only), or mixtures of alcohols, individual hydrocarbons or their mixtures, or mixtures of alcohols with hydrocarbons.

[0014] Alcohols suitable for use in the dental varnish described herein include C₂-C₄ alcohols, including C₃ alcohols, wherein said alcohols may be linear, branched and/or cyclic. Alcohols include ethyl alcohol, propyl alcohol (including its isomers n-propyl alcohol and isopropyl alcohol), butyl alcohol (including its isomers, namely n-butyl alcohol, sec-butyl alcohol, iso-butyl alcohol, and t-butyl alcohol), and blends thereof. Use of alcohols outside the C₂-C₄ range is also contemplated. Suitable hydrocarbons include C₅-C₇ hydrocarbons, including C₆ hydrocarbon compounds, wherein said hydrocarbons may be linear, branched and/or cyclic, and may be alkanes and/or alkenes. A hydrocarbon component may comprise a single hydrocarbon or a blend of two or more hydrocarbons. Specific suitable hydrocarbons include isopentane, n-pentane, n-hexane, isohexanes, cyclohexene, cyclohexane, methylcyclopentane, n-

heptane, methyl cyclohexane, 2,5-dimethylhexane, cyclohexene, methyl cyclohexene, 1-heptene, and mixtures thereof. Use of hydrocarbons outside the C₅-C₇ range is also contemplated.

[0015] The solvent may be present in the dental varnish in amounts of from about 10 weight percent to about 35 weight percent, such as from about 15 weight percent to about 30 weight percent or from about 20 weight percent to about 25 weight percent.

Oxide

[0016] In embodiments, the dental varnish disclosed herein may be clear or substantially transparent. In alternative embodiments, the dental varnish may include a white or substantially white tint. When the dental varnish has such a tint, the dental varnish will include at least one oxide of titanium, zirconium, germanium, tin, zinc, iron, chromium, vanadium, tantalum, niobium, and mixtures thereof. When present the oxide may be present in the dental varnish in amounts of from about 0 weight percent to about 2 weight percent, such as from about 0.01 weight percent to about 1 weight percent or from about 0.08 weight percent to about 1 weight percent.

Flavor additive and sweetener

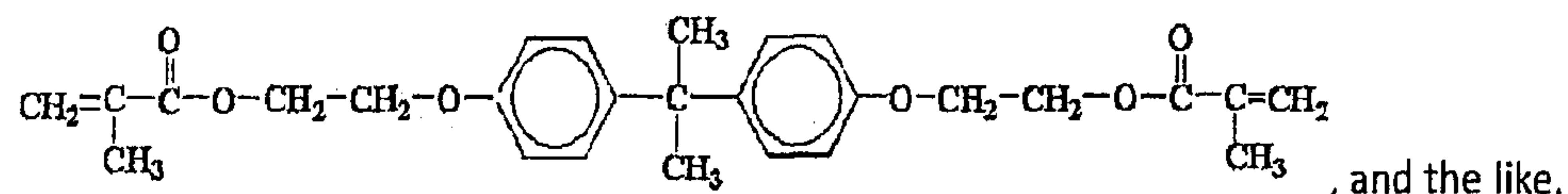
[0017] The dental varnish disclosed herein may include sweeteners, such as xylitol, sorbitol, sucralose, aspartame, sodium saccharin, and mixtures thereof. Such sweeteners may be in the dental varnish in amounts of from about 0.01 weight percent to about 2 weight percent, such as from about 0.05 weight percent to about 1.5 weight percent or from about 0.08 weight percent to about 1 weight percent.

[0018] The dental varnish disclosed herein may include flavorings, including but not limited to, peppermint, watermelon, wintergreen, spearmint, cherry, citric acid, orange, strawberry, vanilla, coconut, bubble gum flavors and mixtures thereof. Such flavoring additives may be in the dental varnish in amounts of from about 0.01 weight percent to about 5 weight percent, such as from about 0.1 weight percent to about 4 weight percent or from about 0.7 weight percent to about 3 weight percent.

[0019] The resulting dental varnish may have a transparent or white color, or a substantially transparent color having a white or off-white tinge. The viscosity of the dental varnish may be from about 500 cp to about 10,000 cp at 25°C. The specific gravity of the dental varnish may be from about 1 to about 1.2 g/cm³. Unlike prior art dental varnishes, the dental varnish disclosed herein is capable of being transparent or substantially transparent, has a high fluoride release within the first two hours of application, and is capable of being smoothly coated onto a patient's tooth.

64053-652

[0020] Suitable precursor resins include, for example, 2, 2' bis[p-(2'-hydroxy-3' methacryoxypropoxy)phenyl]propane(BisGMA), and the like. A resin suitable for use in the dental varnish disclosed herein includes and ethoxylated (2) bisphenol A dimethacrylate:



[0021] The varnish resin may be made by reacting a suitable precursor resin with an isocyanate, such as, hexamethylene diisocyanate (HMDI) at a temperature of from about 40°C to about 60°C for a time period of from about 6 hours to about 8 hours in a RossTM or Premier mixer at a mixing speed of from about 12 rpm to about 25 rpm. Stannous type catalysts, such as Dabco T-9 (stannous octoate)TM, and at least one stabilizer are suitable for use in manufacturing the dental varnish disclosed herein.

[0022] Stabilizers suitable for use in preparing the dental varnish include butylated hydroxyanisole (BHA), butylated hydroxytoluene (butylhydroxytoluene, BHT), propyl gallate (propyl 3,4,5-trihydroxybenzoate), tert-butylhydroquinone (TBHQ, tertiary butylhydroquinone), calcium propanoate (or calcium propionate), from liquid phenolic compounds such as mixed tocopherols (tocopherols, Vitamin E), rosemary extract, the liquid phenolic acid oregano oil (origanum oil), vegetable oil, from the quinoline-based antioxidant liquid ethoxyquin, from the acid-based antioxidant calcium propanoate (or calcium propionate), and from derivatives or mixtures thereof.

[0023] The dental varnishes disclosed herein exhibit improved fluoride release over 2 hour, 4 hour and 6 hour time periods. At 2 hours, the dental varnishes described herein exhibit a fluoride release of about 14000 µg/g to about 17000 µg/g, such as from about 14500 µg/g to about 16500 µg/g or about 15000 µg/g to about 16000 µg/g. At 4 hours, the dental varnishes described herein exhibit a fluoride release of about 2000 µg/g to about 6000 µg/g, such as from about 2750 µg/g to about 5500 µg/g or from about 3250 µg/g to about 4250 µg/g. At 6 hours, the dental varnishes described herein exhibit a fluoride release of about 1000 µg/g to about 5000 µg/g, such as from about 1250 µg/g to about 3500 µg/g or from about 2000 µg/g to about 3000 µg/g. This amount of fluoride release is a significant improvement over known, competitive dental varnishes.

[0024] The dental varnishes disclosed herein exhibit improved ΔE, which refers to color change between two colors, in this case the color change between the shade of a tooth having a dental varnish thereon and a tooth having no dental varnish. In other words, the dental varnishes according to the

64053-652

present disclosure are colorless. A ΔE of less than 1 is not capable of being noticed or perceived by the human eye. The dental varnishes according to the present disclosure have a ΔE of less than 1, such as from about 0.05 to about 0.98 or from about 0.1 to about 0.9 or from about 0.2 to about 0.85. Such a ΔE is a statistical improvement over known dental varnishes.

[0025] In addition to being colorless, the dental varnishes disclosed herein are also transparent. Transparency is evaluated by the transmittance (%). The higher the transmittance percentage, the more transparent is a dental varnish. The transparency of the dental varnish described herein is at least 50%, such as from about 55% to about 95%, such as from about 60% to about 85% or from about 60% to about 80%. These transmittance percentages or transparencies are significant improvements over known, competitive dental varnishes.

[0026] The dental varnishes described herein may be applied to teeth using a suitable applicator, such as a brush, as is well understood by those skilled in the art. Methods of using the dental varnish to seal a tooth include applying the dental varnish to a tooth.

TEST RESULTS

Fluoride Release

[0027] A varnish sample weighing from about 0.02 g to 0.05 g was applied on the bottom of a ¼ oz white polypropylene cup. 25 ml of deionized water was then added into the cup and pulled out after 2 hours of soaking. Fluoride ion released into the deionized water was measured by an ion selective electrode. Fresh deionized water was then added into the cup and the same procedure was repeated to measure fluoride release after 4 hrs and 6 hrs.

[0028] Table 1 demonstrates a comparison of fluoride release between two clear varnishes with different flavor and competitors' varnish product. It was found in Table 1 that the two clear varnishes according to the present disclosure released significantly more fluoride than the competitors' varnish did in first two hours.

[0029] In addition, the two clear varnishes continued to release more fluoride than the competitors' varnish over 4 hours (see Table 1). The clear varnish according the present disclosure also released more fluoride than Preventech VellaTM, Waterpik UltrathinTM, Medicom DuraFlorTM and Kolorz ClearshieldTM over 6 hours.

[0030] Table 1. Comparison of fluoride release between two Clear Varnishes with different flavors and competitors' product.

64053-652

Sample #	Fluoride Release ($\mu\text{g/g}$)		
	2 hours	4 hours	6 hours
Clear Varnish Watermelon Lot#120815-1	15434 \pm 750	3663 \pm 630	1647 \pm 242
Clear Varnish Strawberry Lot# 120815	15345 \pm 1980	3938 \pm 405	2399 \pm 263
TM TM Preventech Vella Lot#38227	6319 \pm 409	1178 \pm 135	772 \pm 76
TM TM VoCo Profluorid Lot#1201189	6184 \pm 399	2038 \pm 59	1364 \pm 24
TM TM Waterpik Ultrathin Lot#37500	5295 \pm 1221	945 \pm 239	674 \pm 160
TM TM Medicom DuraFlor Lot#39924	5072 \pm 1116	925 \pm 131	610 \pm 71
TM TM Kolorz ClearShield Lot#38651	4797 \pm 873	922 \pm 193	646 \pm 124

[0031] The clear varnishes of Table 1 were prepared by first mixing about 285 grams of 2-propanol with:

- (1) about 520 grams of resin, derived from 2,2' bis[p-(2'hydroxy-3'methacryl(oxypropoxy)phenyl)propane (BisGMA), hexamethylene diisocyanate (HDMI), butylated hydroxyl toluene (BHT) and T-9 catalyst, and
- (2) about 400 grams of fully hydrogenated rosin.

These components were mixed for from about 2 hours to about 14 hours until all of the resin and rosin was dissolved thereby creating a solution. About 65 grams of sodium fluoride, about 1.5 grams of sweetener and 20 grams of flavoring added and the resulting solution was mixed from about 1 hour to about 2 hours until a uniform suspension was formed.

[0032] The resin described above was synthesized by charging a mixture of about 1000 grams of BisGMA, about 171 grams of HDMI, about 0.57 grams of BHT and about 0.57 grams of T-9 into a Ross mixer (Model LDM-1, Charles Ross and Son Co.) equipped with a water jacket and two agitators. The water jacket temperature was increase to 50°C. The mixture was agitated for about 7 hours.

[0033] The two Clear Varnishes having watermelon and strawberry flavoring released more fluoride in the first two hours than major competitors and continued to release more fluoride over the 4 and 6 hour time periods.

64053-652

Color Test

[0034] Four composite chips (n=4) were prepared using DentsplyTM Universal Composite, EsthetX HD A2TM shade. Composite was filled into a stainless steel ring mold with a dimension of 30mm (inside diameter) x 1.0mm (thickness) and covered with a pair of glass plates on the top and bottom of composite. The composite was then cured with a Triad 2000 curing light (DentsplyTM) for about 2 minutes on each side. Color value: L*, a*, and b* of the prepared chips were measured using Color i5, a colorimeter manufactured by Gretagmacbeth. A dental varnish sample was mixed using a varnish brush until a uniform slurry was formed. About 0.06 gram of varnish was weighed and spread on the top of each of the composite chips to make a uniform coating using a varnish brush. The coating was dried at room temperature for at least 24 hours until the coating was completely dry. L*, a*, and b* value of the coated surface was measured by the colorimeter.

[0035] ΔE was calculated using the following formula:

$$[0036] \Delta E = ((a_1^* - a_2^*)^2 + (b_1^* - b_2^*)^2 + (L_1^* - L_2^*)^2)^{1/2}$$

[0037] a_1^* : Red & Green value before varnish coating

[0038] a_2^* : Red & Green value after varnish coating

[0039] b_1^* : Yellow & Blue value before varnish coating

[0040] b_2^* : Yellow & Blue value after varnish coating

[0041] L_1^* : Lightness value before varnish coating

[0042] L_2^* : Lightness value after varnish coating

[0043] Table 2 shows a comparison of color change between two clear varnishes with different flavor according to the present disclosure and competitors' varnish products. The color change before and after coating was measured by the value of ΔE , which is defined as the difference between two colors in an L*a*b* color space. It is universally valid that when ΔE is less than 2, the color difference will not be perceived by human eyes. As demonstrated in Table 2 below, ΔE of the two Clear Varnishes according to the present disclosure was less than 2. Therefore, the two clear coatings did not change the shade of the teeth or alter the color of teeth.

[0044] In addition, Table 2 also demonstrates that the ΔE of two clear varnishes was statistically lower than Kolorz ClearShieldTM, Waterpik UltrathinTM and Preventech VellaTM and were comparable to MedicomTM DuraFlorTM.

[0045] Table 2. Comparison of Delta E between two Clear Varnishes with different flavor and competitors' product.

64053-652

Sample #	Delta E	
	Average	Standard Deviation
Clear Varnish Strawberry Lot# 120815	0.63	0.04
Clear Varnish Watermelon Lot# 120815-1	0.81	0.06
Medicom™ DuraFlor™ Lot #39924	1.16	0.10
Waterpik™ Ultrathin™ Lot#37500	1.58	0.32
Kolorz™ ClearShield™ Lot#38651	3.59	0.34
Preventech™ Vella™ Lot#38227	4.04	0.42

Fig. 1 is a bar graph of Delta E before and after varnish coating for two Clear Varnishes with different flavor and competitors' product.

[0046] The ΔE of the two Clear Varnishes according to the present disclosure has met the stated acceptance criteria and are considered colorless on a tooth surface. The ΔE of the two clear varnishes according to the present disclosure was statistically lower than Kolorz ClearShield, Waterpik Ultrathin and Preventech Vella and is comparable to Medicom DuraFlor.

64053-652

Transparency Test

[0047] From about 0.08 to 0.12 grams of dental varnish was weighed on a mylar sheet, and the sample was arranged into a rectangular shape (about 10mm x 5 mm) using a stainless steel spatula. The 2 mil side of a Wet Film Applicator was used and drawn down against the varnish at a constant speed of about one inch per second. A minimum of nine specimens (n=9) was needed for each varnish product. The transmittance of the drawn-down varnish was measured by a UV-vis spectrophotometer.

[0048] Table 3 shows a comparison of the transmittance between two clear varnishes with different flavor according to the present disclosure and competitors' varnish products. The transmittance is the fraction of incident light at a specified wavelength that passes through a sample. The higher the transmittance, the more transparent the sample is. As demonstrated in Table 3, the transmittance of the two Clear Varnishes with different flavor according to the present disclosure was statistically higher than their competitors' varnish.

[0049] Table 3. Comparison of Transmittance between two Clear Varnishes with different flavor and competitors' product.

Sample #	Transmittance (%)	
	Average	Standard Deviation
Clear Varnish Strawberry Lot# 120815	65.6	3.5
Clear Varnish Watermelon Lot#120815-1	65.1	1.9
VoCo TM Profluorid TM Lot#1201189	48.9	4.9
Kolorz TM ClearShield TM Lot#38651	35.3	2.1
Medicom TM DuraFlor TM Lot#39924	34.9	3.1
Waterpik TM Ultrathin TM Lot#37500	26.1	2.8

[0050] As can be seen from Table 3, the Clear with Strawberry and Watermelon flavor according to the present disclosure were more transparent than any of the competitors' varnish products.

[0051] It will be appreciated that various of the above-disclosed compositions and other features and functions, or alternatives thereof, may be desirably combined into many other different systems or applications. Also, various presently unforeseen or unanticipated alternatives, modifications, variations

or improvements therein may be subsequently made by those skilled in the art, and are also intended to be encompassed by the following claims.

64053-652

CLAIMS:

1. A dental varnish comprising a rosin, a vinyl type resin, a fluoridizing agent, a solvent, an optional remineralization agent, an optional flavor additive, an optional sweetener and optionally an oxide.
- 5 2. The dental varnish according to claim 1, wherein the rosin is a hydrogenated rosin.
3. The dental varnish according to claim 2, wherein the rosin is at least a partially hydrogenated rosin.
4. The dental varnish according to claim 1, wherein the dental varnish
10 exhibits a fluoride release over a two hour time period of from 14000 $\mu\text{g/g}$ to 17000 $\mu\text{g/g}$.
5. The dental varnish according to claim 1, wherein the dental varnish exhibits a ΔE of less than 1, and wherein ΔE is the color change between the shade of a tooth having a dental varnish thereon and the shade of a tooth having no dental
15 varnish.
6. The dental varnish according to claim 5, wherein the ΔE is from 0.05 to 0.98.
7. The dental varnish according to claim 1, wherein the dental varnish exhibits a transmittance of at least 50%.
- 20 8. The dental varnish according to claim 7, wherein the transmittance is from 55% to 95%.
9. The dental varnish according to claim 1, wherein the rosin is present in the dental varnish in amounts of from 5 weight percent to 75 weight percent.
10. The dental varnish according to claim 9, wherein the rosin is present in
25 the dental varnish in amounts of from 18 weight percent to 60 weight percent.

64053-652

11. The dental varnish according to claim 10, wherein the rosin is present in the dental varnish in amounts of from 29 weight percent to 35 weight percent.
12. A dental varnish comprising a rosin, resin, a fluoridizing agent, a solvent, an optional remineralization agent, an optional flavor additive, an optional
5 sweetener and optionally an oxide, wherein the dental varnish is transparent, exhibiting a transmittance of at least 50%, wherein the rosin is present in the dental varnish from about 18 to about 60 percent by weight and wherein the resin is a reaction product of 2,2' bis[p-(2'-hydroxy-3' methacryloxypropoxy)phenyl]propane (BisGMA) and hexamethylene diisocyanate (HMDI) and is present in the dental
10 varnish from about 25 to about 60 percent by weight.
13. The dental varnish according to claim 12, wherein the rosin is a hydrogenated rosin.
14. The dental varnish according to claim 13, wherein the rosin is at least a partially hydrogenated rosin.
- 15 15. The dental varnish according to any one of claims 12-14, wherein the dental varnish exhibits a fluoride release over a two hour time period of from 14000 $\mu\text{g/g}$ to 17000 $\mu\text{g/g}$.
16. The dental varnish according to any one of claims 12-15, wherein the dental varnish exhibits a ΔE of less than 1, and wherein ΔE is the color change
20 between the shade of a tooth having a dental varnish thereon and the shade of a tooth having no dental varnish.
17. The dental varnish according to claim 16, wherein the ΔE is from 0.05 to 0.98.
18. The dental varnish according to any one of claims 12-17, wherein the
25 transmittance is from 55% to 95%.

64053-652

19. The dental varnish according to any one of claims 12-18, wherein the rosin is present in the dental varnish in amounts of from 29 weight percent to 35 weight percent.
20. The dental varnish according to any one of claims 12-19 comprising the
5 remineralization agent.
21. A one-part dental varnish comprising a solution of a rosin and a non-rosin resin in a common solvent and further comprising a fluoridizing agent, wherein the dental varnish is transparent, exhibiting a transmittance of at least 50%, the rosin is present in the dental varnish in an amount of from about 18 to about 60 percent by
10 weight and the resin is present in the dental varnish in an amount of from about 25 to about 60 percent by weight.
22. The dental varnish of claim 21, wherein the rosin is a hydrogenated rosin.
23. The dental varnish of claim 22, wherein the rosin is a fully hydrogenated
15 rosin.
24. The dental varnish of any one of claims 21-23, wherein the rosin has an acid number in the range of 140 to 175.
25. The dental varnish of any one of claims 21-24, wherein the rosin is present in the dental varnish in an amount of from 29 weight percent to 35 weight
20 percent.
26. The dental varnish of any one of claims 21-25, wherein the rosin is a colorless rosin selected from the group consisting of wood rosin, gum rosin, tall oil rosin, and combinations thereof.
27. The dental varnish of any one of claims 21-26, wherein the resin is a
25 colorless reaction product of a precursor resin and an isocyanate.

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28. The dental varnish of any one of claims 21-27, wherein the varnish has a viscosity in the range of about 500 cP to about 10,000 cP at 25° C.
29. The dental varnish of any one of claims 21-28, wherein the dental varnish has a specific gravity in the range of 1 to 1.2.
- 5 30. The dental varnish of any one of claims 21-29, wherein the dental varnish exhibits a ΔE from 0.05 to 0.98, and wherein ΔE is the color change between the shade of a tooth having a dental varnish thereon and the shade of a tooth having no dental varnish.
- 10 31. The dental varnish of any one of claims 21-30, wherein the transmittance is from 55% to 95%.
32. The dental varnish of any one of claims 21-31 further comprising a remineralization agent.
33. The dental varnish of any one of claims 21-32 further comprising a flavor additive, a sweetener, or a combination thereof.
- 15 34. A one-part dental varnish comprising a solution of a fully hydrogenated rosin and a colorless non-rosin resin in a common solvent and further comprising a fluoridizing agent, wherein the dental varnish is a clear, transparent dental varnish, the rosin is present at about 18 to about 60 percent by weight of the varnish, the resin is present at about 25 to about 60 percent by weight of the varnish, and the
20 fluoridizing agent is present at about 0.1 to about 8 percent by weight of the varnish.

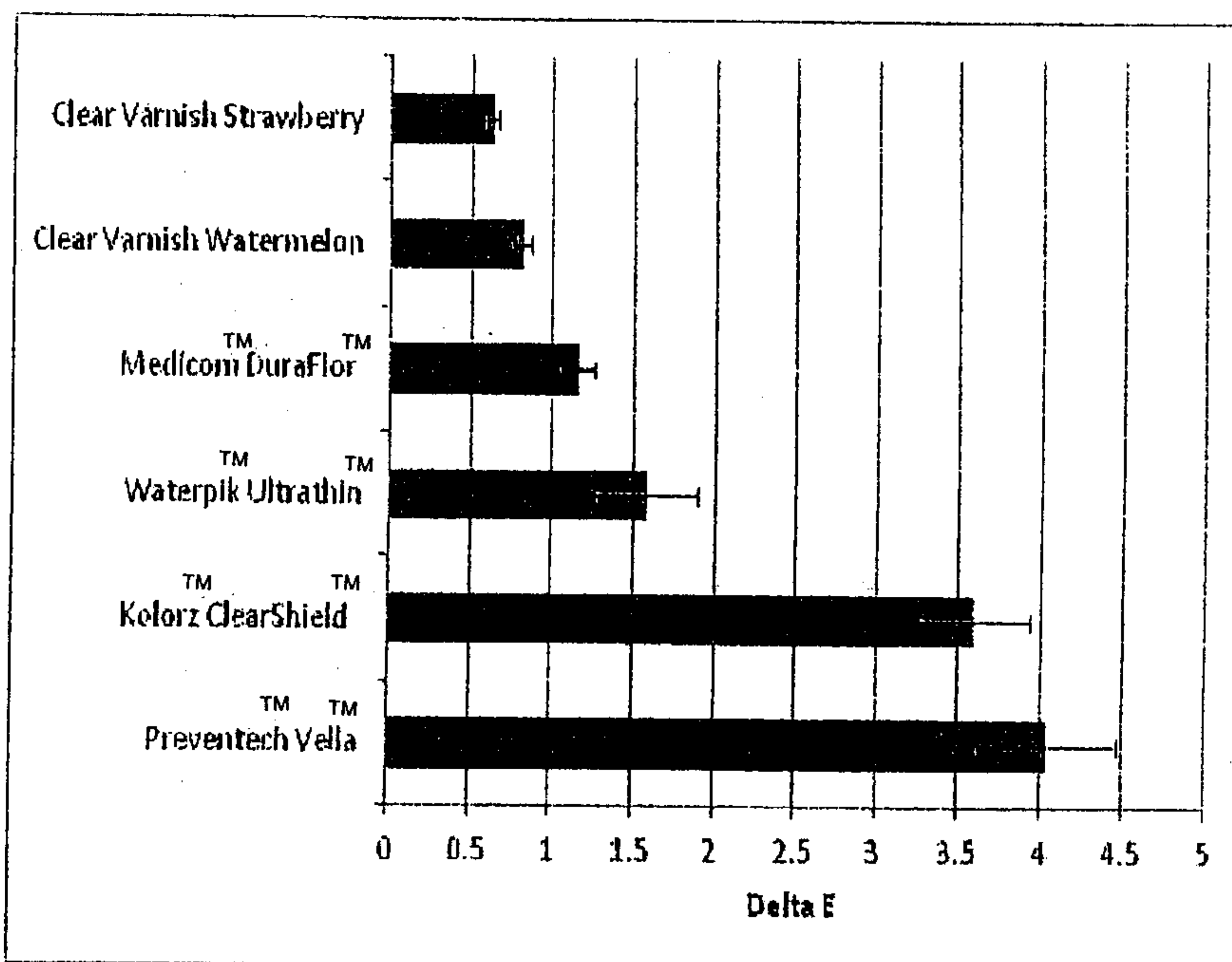


Fig 1.