

DENTAL FLOSS

[0001] This application claims the benefit of United States Patent Application Serial No. 61/027,436 filed February 8, 2008, the contents of which application is incorporated herein by reference.

BACKGROUND OF THE INVENTION

[0002] The use of dental floss and other interdental cleaners are an important part of dental hygiene, and are used to remove plaque and other particulate from between the teeth and under the gum line, e.g., areas in the mouth where a toothbrush cannot reach. Frequently, these are the initiation sites of tooth decay, especially if not cleaned regularly. However, even with routine maintenance, caries and gingivitis still develop in these areas. Thus, there is a continuing need to develop more effective dental flosses.

[0003] While it is recommended that people floss their teeth at least daily, the reality is that few people floss as often as recommended. Thus there is a need for more effective dental floss compositions for use by occasional flossers.

SUMMARY OF THE INVENTION

[0004] It has been discovered that basic amino acids provide beneficial effects in inhibiting bacterial attachment, promoting remineralization of the teeth, reducing the incidence of cavities and dentinal hypersensitivity, and inhibiting cariostatic bacteria in favor of arginolytic bacteria.

[0005] The present invention provides a dental floss in combination or association with a composition comprising a basic amino acid or salt thereof, e.g., arginine, arginine bicarbonate, arginine hydrochloride, or arginine phosphate. The basic amino acid or salt may be coated onto the floss, or impregnated within the floss matrix, or the dental floss may be dispensed using a package wherein the floss is stored or dispensed via a chamber comprising a composition comprising a basic amino acid, e.g., any of compositions 1.1-1.15 below.

[0006] The invention thus includes a dental floss in combination or association with (e.g., coated or impregnated with) a composition (Composition 1.0) comprising a basic amino acid or salt thereof, e.g., a dental floss in combination or association with any of the following Compositions:

- 1.1. Composition 1.0 wherein the basic amino acid is arginine, lysine, citrulline, ornithine, creatine, histidine, diaminobutanoic acid, diaminopropionic acid, salts thereof and/or combinations thereof.
- 1.2. Composition 1.0 or 1.1 wherein the basic amino acid has the L-configuration.

- 1.3. Any of the preceding compositions is provided in the form of a salt of a di- or tri-peptide comprising the basic amino acid.
- 1.4. Any of the preceding compositions wherein the basic amino acid is arginine.
- 1.5. Any of the preceding compositions wherein the basic amino acid is L-arginine.
- 1.6. Any of the preceding compositions comprising a physiologically acceptable salt of a basic amino acid.
- 1.7. Any of the preceding compositions wherein the salt of the basic amino acid is a carbonate.
- 1.8. Any of the preceding compositions wherein the salt of the basic amino acid is a bicarbonate.
- 1.9. Any of the preceding compositions wherein the basic amino acid salt is arginine bicarbonate.
- 1.10. Any of the preceding compositions further comprising fluoride, or a fluoride ion source.
- 1.11. Any of the preceding compositions comprising a fluoride ion source selected from stannous fluoride, sodium fluoride, potassium fluoride, sodium monofluorophosphate, sodium fluorosilicate, ammonium fluorosilicate, amine fluoride, ammonium fluoride, and combinations thereof.
- 1.12. Any of the preceding compositions further comprising an antiseptic or antimicrobial.
- 1.13. Any of the preceding compositions further comprising an antibacterial agent selected from triclosan, herbal extracts and essential oils (e.g., rosemary extract, tea extract, magnolia extract, thymol, menthol, eucalyptol, geraniol, carvacrol, citral, hinokitol, catechol, methyl salicylate, epigallocatechin gallate, epigallocatechin, gallic acid, miswak extract, sea-buckthorn extract, propolis), bisguanide antiseptics (e.g., chlorhexidine, alexidine or octenidine), quaternary ammonium compounds (e.g., cetylpyridinium chloride (CPC), benzalkonium chloride, tetradecylpyridinium chloride (TPC), N-tetradecyl-4-ethylpyridinium chloride (TDEPC)), phenolic antiseptics, hexetidine, octenidine, sanguinarine, povidone iodine, delmopinol, salifluor, metal ions (e.g., zinc salts, for example, zinc citrate, stannous salts, copper salts, iron salts), sanguinarine, propolis and oxygenating agents (e.g., hydrogen peroxide, buffered sodium peroxyborate or peroxy carbonate), phthalic acid and its salts, monoperthalic acid and its salts and esters, ascorbyl stearate, oleoyl sarcosine, alkyl sulfate, dioctyl sulfosuccinate, salicylanilide, domiphen bromide, delmopinol, octapinol and other piperidino derivatives, nicin preparations, chlorite salts; and mixtures of any of the foregoing.

1.14. Any of the preceding compositions further comprising additional ingredients selected from analgesic agents, anti-inflammatory agents, coagulants, astringents, vitamins, and combinations thereof.

1.15. Any of the preceding compositions further comprising binders, waxes or carriers.

[0007] The present invention further comprises a package for storing or dispensing dental floss comprising a chamber containing a basic amino acid, wherein the floss is exposed to the basic amino acid during storage or dispensing, e.g., wherein the chamber contains a composition comprising a basic amino acid, e.g., a composition according to any of compositions 1.0-1.15.

[0008] The present invention also encompasses method 2.0, a method to (i) reduce or inhibit formation of dental caries, (ii) reduce, repair or inhibit pre-carious lesions of the enamel, e.g., as detected by quantitative light-induced fluorescence (QLF) or electrical caries measurement (ECM), (iii) reduce or inhibit demineralization and promote remineralization of the teeth, (iv) reduce hypersensitivity of the teeth, (v) reduce or inhibit gingivitis, (vi) promote healing of sores or cuts in the mouth, (vii) reduce levels of acid producing bacteria, (viii) to increase relative levels of arginolytic bacteria, (ix) inhibit microbial biofilm formation in the oral cavity, (x) raise and/or maintain plaque pH at levels of at least pH 5.5, (xi) reduce plaque accumulation, (xii) clean the teeth and oral cavity, (xiii) immunize the teeth against cariogenic bacteria, and/or (xiv) reduce erosion, (xv) enhance systemic health, and/or (xvi) treat or inhibit dry mouth, the method comprising flossing the teeth or other surfaces of the oral cavity of a patient in need thereof with a dental floss in combination or association with a basic amino acid in free or salt form (e.g., in combination or association with any of Compositions 1.0-1.15 as hereinbefore described).

[0009] Other embodiments of the present invention will be apparent to one of skill in the art.

DETAILED DESCRIPTION OF THE INVENTION

[0010] Without intending to be bound by a particular theory, it is believed that basic amino acids in the oral cavity are metabolized by certain types of bacteria, e.g., *S. sanguis* which are not cariogenic and which compete with cariogenic bacteria such as *S. mutans*, for position on the teeth and in the oral cavity. The arginolytic bacteria can use arginine and other basic amino acids to produce ammonia, thereby raising the pH of their environment, while cariogenic bacteria metabolize sugar to produce lactic acid, which tends to lower the plaque

pH and demineralize the teeth, ultimately leading to cavities. It is believed that use of a Composition of the Invention may lead to a relative increase in the arginolytic bacteria and a relative decrease in the cariogenic bacteria, resulting in a higher plaque pH and a corresponding reduction in the cavitation process.

[0011] The basic amino acids which can be used in the compositions of the present the invention include not only naturally occurring basic amino acids, such as arginine, lysine, and histidine, but also any basic amino acids having a carboxyl group and an amino group in the molecule. Accordingly, basic amino acids include, but are not limited to, arginine, lysine, citrulline, ornithine, creatine, histidine, diaminobutanoic acid, diaminopropionic acid, salts thereof or combinations thereof. In a particular embodiment, the basic amino acids are selected from arginine, citrulline, and ornithine, preferably, arginine, for example, l-arginine.

[0012] The compositions of the invention are used in the mouth, so salts for use in the present invention should be safe for such use, in the amounts and concentrations provided. Suitable salts include salts known in the art to be pharmaceutically acceptable salts are generally considered to be physiologically acceptable in the amounts and concentrations provided. Physiologically acceptable salts include those derived from pharmaceutically acceptable inorganic or organic acids or bases, for example acid addition salts formed by acids which form a physiological acceptable anion, e.g., hydrochloride or bromide salt, and base addition salts formed by bases which form a physiologically acceptable cation, for example those derived from alkali metals such as potassium and sodium or alkaline earth metals such as calcium and magnesium. Physiologically acceptable salts may be obtained using standard procedures known in the art, for example, by reacting a sufficiently basic compound such as an amine with a suitable acid affording a physiologically acceptable anion. A preferred salt is a bicarbonate, e.g., arginine bicarbonate.

[0013] Methods of manufacturing dental floss are well known in the art. For example, dental floss may be produced from nylon, as nylon salt is polymerized and the resulting polymer is pumped or extruded to form monofilaments. The filaments are allowed to harden, and then combined to form a strand of floss. Dental floss may be produced from polytetrafluoroethylene (PTFE or Teflon®), polypropylene, polyethylene, styrene butadiene copolymers, combination of them. The polymer is melted and extruded into thin strands. See also US Patent 6,270,890, the contents of which are herein incorporated by reference.

[0014] In one embodiment, resin, e.g., nylon or PTFE, is mixed with a basic amino acid, or

a salt thereof, and extruded to form a filament (e.g., in the case of nylon) which are twisted to form the floss, or formed into a single ribbon of floss (e.g., in the case of PTFE). It should be understood that some of the basic amino acid or salt will be disposed near the surface of the floss, and will be exposed and released when the dental floss is used. In one embodiment, the floss has a denier of about 450 to about 1350. In another embodiment the denier of the floss is from about 100 to about 900.

[0015] Method for coating dental floss is also known in the art. In one embodiment of the present invention, the dental floss is treated in an emulsion bath comprising arginine or a pharmaceutically acceptable salt thereof. The emulsion bath may optionally contain one or more waxes, which adhere to the floss, and thereby cause the arginine to adhere to the floss. In another embodiment, a dental floss comprising a non-PTFE fiber is coated with a first and a second coating overlaying the first coating. The first coating is a nylon bonding coating, and the second coating is a wax or polymer, e.g., such as polyvinyl alcohol, polyvinyl acetate, etc, in combination or association with a basic amino acid or salt thereof. See e.g., US patent 6,289,904, herein incorporated by reference.

[0016] The floss may be in the form of a single ribbon (e.g., a Teflon® or polyethylene ribbon). Alternatively, it may be bundle of thin filaments, e.g., nylon filaments. The number of filaments will be from about 2 to about 300, e.g., from about 2 to about 200, depending on the denier of the filaments. The filaments are twisted with about 1 to 5 twists per inch to form the floss. The twisting provides integrity of the floss on the spool and during subsequent handling. However, when used the filaments will spread out and splay against tooth surfaces. The floss may also be formed of interlocking fibers, e.g., as in the case Oral-B Ultra Floss™. In any case the final floss product is preferably of a thickness that allows it to fit between the teeth. The floss may be coated with a wax. Where multiple filaments are used, the coating may applied before or after twisting, preferably after twisting. Other additives may be applied to a wax coated floss after the wax coating. The flavor can be applied as a liquid or a solid. It is preferred to use a spray dried solid. Likewise, the various other additives can be applied as a liquid or a solid. When applied as a liquid the floss is dried prior to being wound onto a spool. The drying can be by radiant drying or air drying. After drying, the floss is wound onto a spool.

[0017] Dental floss is commonly supplied in plastic dispensers that contain 10 to 50 meters of floss. The dispenser typically has a small protected blade used to sever the floss when a desired amount is pulled out.

[0018] In one embodiment of the present invention, a dental floss dispenser is provided which contains a basic amino acid, salt, or solution thereof is disposed within the container and in contact with the floss. As the floss is stored or as a user pulls out a desired amount of floss, the floss comes in contact with the basic amino acid, salt, or solution, thereby coating the floss.

[0019] Various devices have been developed to aid a user in flossing their teeth, especially when flossing of the particular tooth is difficult or awkward. Such devices are shaped like wands to hold the floss. The present invention contemplates the use basic amino acids and their salts in combination with such devices. Additionally, dental floss that do not contain a basic amino acid or salt and retained on such wands may be dipped into a basic amino acid, salt, or solution thereof to take advantage of the present invention.

[0020] In one embodiment of the present invention, the dental floss may optionally include fluoride, or a fluoride ion source. A wide variety of fluoride ion-yielding materials can be employed as sources of soluble fluoride in the present compositions. Examples of suitable fluoride ion-yielding materials are found in U.S. Pat. No. 3,535,421, to Briner et al.; U.S. Pat. No. 4,885,155, to Parran, Jr. et al. and U.S. Pat. No. 3,678,154, to Widder et al., incorporated herein by reference. Representative fluoride ion sources include, but are not limited to, stannous fluoride, sodium fluoride, potassium fluoride, sodium monofluorophosphate, sodium fluorosilicate, ammonium fluorosilicate, amine fluoride, ammonium fluoride, and combinations thereof. In certain embodiments the fluoride ion source includes stannous fluoride, sodium fluoride, sodium monofluorophosphate as well as mixtures thereof.

[0021] The dental floss of the present invention may also comprise abrasive particles, e.g., aluminium oxide, small particle silica, or other abrasive or polishing particles. See e.g., US Patent 6,453,912, incorporated herein by reference.

[0022] The dental floss of the present invention may also comprise an antiseptic or antimicrobial selected from triclosan, herbal extracts and essential oils (e.g. rosemary extract, thymol, menthol, eucalyptol, methyl salicylate), bisguanide antiseptics (e.g., chlorhexidine, alexidine or octenidine), quaternary ammonium compounds (e.g., cetylpyridinium chloride), phenolic antiseptics, hexetidine, povidone iodine, delmopinol, salifluor, metal ions (e.g., zinc salts, for example, zinc citrate), sanguinarine, propolis, and combinations thereof to further aid in the beneficial effects of the basic amino acid.

[0023] As use of dental floss may cause discomfort or bleeding during or after use, it may optionally comprise analgesic agents, anti-inflammatory agents, coagulaants, vitamins, and combinations thereof.

CLAIMS

1. A dental floss in combination or association with a basic amino acid.
2. The floss of claim 1 wherein the basic amino acid is a physiologically acceptable salt of the basic amino acid.
3. The floss of claims 1 or 2 wherein the basic amino acid is arginine, lysine, citrulline, ornithine, creatine, histidine, diaminobutanoic acid, diaminopropionic acid, salts thereof and/or combinations thereof.
4. The floss of any of the preceding claims wherein the basic amino acid has the L-configuration.
5. The floss of any of the preceding claims wherein the basic amino acid is arginine.
6. The floss of any of the preceding claims wherein the basic amino acid is L-arginine.
7. The floss of any of the preceding claims wherein the salt of the basic amino acid is a carbonate.
8. The floss of any one of claims 2 – 6 wherein the salt of the basic amino acid is a bicarbonate.
9. The floss of any one of claims 2 – 5 and 8 wherein the basic amino acid salt is arginine bicarbonate.
10. The floss of any one of the preceding claims further comprising a fluoride ion source.
11. The floss of any of Claims 1-10 further comprising an antiseptic or antimicrobial compound.
12. The floss of any of Claims 1-11 further comprising additional ingredients selected from analgesic agents, coagulants, anti-inflammatory agents, opioids, and vitamins.
13. The floss of any of Claims 1-12 further comprising binders, waxes or carriers.

14. The floss of any of Claims 1-13 wherein the floss is coated or impregnated with the basic amino acid.

15. A package for storing or dispensing dental floss comprising a chamber containing a basic amino acid, wherein the floss is exposed to the basic amino acid during storage or dispensing.

16. A method for manufacturing dental floss comprising admixing a basic amino acid with a monomer, reacting the monomer to produce a polymer, and forming the polymer into one or more filaments.

17. A floss obtained or obtainable by the method of claim 16.

18. A method to (i) reduce or inhibit formation of dental caries, (ii) reduce, repair or inhibit pre-carious lesions of the enamel, (iii) reduce or inhibit demineralization and promote remineralization of the teeth, (iv) reduce hypersensitivity of the teeth, (v) reduce or inhibit gingivitis, (vi) promote healing of sores or cuts in the mouth, (vii) reduce levels of acid producing bacteria, (viii) to increase relative levels of arginolytic bacteria, (ix) inhibit microbial biofilm formation in the oral cavity, (x) raise and/or maintain plaque pH at levels of at least pH 5.5, (xi) reduce plaque accumulation, (xii) clean the teeth and oral cavity, (xiii) immunize the teeth against cariogenic bacteria, and/or (xiv) reduce erosion, (xv) enhance systemic health, and/or (xvi) treat or inhibit dry mouth, the method comprising flossing the teeth or other surfaces of the oral cavity of a patient in need thereof with a dental floss in combination or association with a basic amino acid in free or salt form.