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(54) **Toothbrush with slow release of disinfectant and anti-bacterial agents and method of manufacturing the same.**

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**DE-C- 451 728**

**SCIENCE, vol. 324, 10th July 1981, pages 233-235, AAAS; T. LEE et al.: "Serum albumin beads: An injectable, biodegradable system for the sustained release of drugs"**

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## Description

Health care costs are increasing dramatically in the United States and other countries. A significant component of these escalating costs is tooth and gum disease.

Advances in dentrifice compositions and modalities for treatment of periodontal disease have greatly assisted in the prevention and treatment of these conditions.

However, the primary tool for every day cleaning of teeth remains the common toothbrush. Since the toothbrush frequently comes into contact with the oral environment and may be subsequently left in a non-sterile environment until subsequent use, the toothbrush bristles can harbour bacteria and upon re-use of the toothbrush, the bristles can become a source for introducing bacteria into the oral cavity.

Additionally, the toothbrush has not been used as a source of medication but, rather, as an applicator for dentrifice. There would be merit in using the toothbrush as such a medication source, preferably as a complement to the dentrifice if a viable and practical low-cost means for doing so could be found.

Although the technical problem of designing a toothbrush capable of delivering dentrifice and other agents has long been recognized, no satisfactory workable system has been developed to meet this long-felt need.

The prior art illustrates that this is so. For example, U.S. Patent 914,501 is an early approach wherein a reservoir is formed along the sides of the bristles to contain liquid dentrifice. This disclosure fails to provide long-lasting means for release of dentrifice or other agents since the liquid dentrifice would be washed from the oral cavity with each use.

Another attempt to solve the problem is disclosed in U.S. Patent 1,238,883 wherein the "bristles" of the brush are vulcanized rubber and incorporated polishing and cleaning substances.

In U.S. Patent 1,214,556 a cotton insert containing dentifrice is placed in the brush. This is believed to be impractical as it would require consumers to undertake the cumbersome task of replacing inserts after every use. A similar insert device is described in U.S. Patent 4,588,089 wherein an envelope containing toothpaste is inserted in a toothbrush and released by a spike. This technique is also employed in U.S. Patent 3,316,580 which suggests the use of an envelope disposed between the bristles. Such devices requiring inserts are complicated to use.

Similar reservations would apply to U.S. Patent 4,453,679 in which the handle of the toothbrush has a separate attachment for releasing various

agents. Indeed, the handle-dispensing approach is the subject of a number of earlier efforts to solve the problem such as U.S. Patents 1,896,982; 2,077,758 and 2,303,667, plus U.K. Patent 259,268.

Another approach believed to be unsuccessful is to coat or to spray the bristles with various agents. Representatives of this group are U.S. Patents 1,982,660; 3,302,230; 3,691,585 and Canadian Patent 549,168.

It is evident from examination of the above patents that none of the devices solves the twin problems of maintaining bristles of the toothbrush sterile in a practical manner and providing a viable slow release mechanism for anti-bacterial agents or other medications.

A different approach is shown in British Patent 259,268 wherein a disinfectant is disposed to communicate with the tuft holes of the bristles. However, even in Figures 7-9 of the patent, the reservoir is not located within the tuft holes themselves, nor is there any suggestion of the use of medications other than disinfectants. Importantly, this patent fails to teach how the material to be transferred to the bristles is, in fact, so communicated there to and absorbed by them. In view of the fact that virtually all toothbrushes on the market today employ hydrophobic plastic bristles, it is not understood how the device of this patent would operate to transfer disinfectant or other medications up through the bristles of such modern toothbrushes.

In DE-C 451 728 the brushing head has tuft holes containing a disinfectant to be released during brushing.

Figure 3 of U.K. Patent 1,026,738 discloses recesses 6 disposed annularly around the upper interior perimeter of tuft holes 4 to provide a source of dentrifice when the brush is immersed in water. This patent, again, fails to teach how a long-lasting source of disinfectant and/or other medications can be maintained over extended periods or be absorbed by the bristles over such long periods, i.e., over a period of extended use, as opposed to prior art teachings which disclose systems which would be effective for only a single use.

It is an object of this invention to provide a toothbrush so designed that it will incorporate means for maintaining the brush sterile over long periods.

It is another object of this invention to provide a toothbrush which is capable over long periods of time of releasing anti-bacterial agents and other medications.

It is yet another object of the invention to provide disinfectants and/or other materials in slow-release form incorporated in the toothbrush structure so that the materials are released through the bristles over extended time periods to keep the toothbrush sterile and clean and, if medications are

used, to assist in the application thereof to the teeth during brushing.

These and further objects of the invention will be observed from the following detailed description, the drawings and the claims.

## THE DRAWING

The drawing illustrates, in schematic form, a cross-section of a portion of the head of a toothbrush suitable for the present invention.

## DETAILED DESCRIPTION

As indicated, it is known that toothbrushes of conventional manufacture are not sterile and, in fact, harbour bacteria which transfers into the oral cavity during repeated brushings. Thus, the primary instrument for tooth cleaning itself can be source of infection within the mouth.

It would be desirable, in addition to eliminating the foregoing infection problem, to provide a toothbrush which is capable of releasing medication effective against tooth and gum disease over extended periods of time, that is, during multiple uses of the toothbrush.

Certain of the prior patents discussed above recognize the problem of toothbrush sterility and the desirability of using the toothbrush to deliver medication.

The solution to these long-recognized needs is the device of the present invention wherein disinfectant, medication or a mixture thereof is contained in a slow-release material. Subsequently, during repeated brushings, the water and saliva present in the oral cavity during brushing seeps into the tuft holes and causes the release of measured amounts of the disinfectant and/or medication. These agents travel up the tuft hole and out of it and into the oral cavity during brushing. Moreover, at the end of brushing, there is sufficient disinfectant remaining on the bristles and toothbrush head and adjacent portions of the handle to sterilize the same so that bacteria will not build up on the brush and contaminate the mouth upon succeeding toothbrushings over an extended period of time, say about 2 to 3 months.

To illustrate one embodiment of the invention, the drawing shows, in schematic form, a cross-section of a portion of the head of a toothbrush suitable for the present invention. Thus, the device is generally designated 10 and has a brush head 11. Two tuft holes for the bristles, 15 and 16, are depicted in brush head 11.

As shown the bristles or filament 13 are inserted into the holes 15 and 16, most commonly by an anchor 17, typically composed of aluminum or an alloy such as brass or silver-nickel.

In operation, the toothbrush is employed in the usual fashion, i.e., dentifrice is applied to the bristles and the brush is inserted into the oral cavity for brushing. The water and saliva generated during this process causes measured amounts of disinfectant and/or medication to pass from their capsule enclosures and up along the bristles out of the tuft holes and into the mouth. At the end of brushing, sufficient disinfectant remains on the bristles to render the same sterile, thereby preventing the formation of bacterial colonies and fungal growth which, in the case of prior art toothbrushes, infect the oral cavity when the toothbrush is next used.

The slow-release material may be of natural or synthetic polymers, e.g., gelatin, polyvinylpyrrolidone and hydroxyethylmethacrylate.

As disinfectants to kill bacteria and fungal colonies on the bristles and brush, antimicrobial agents such as chlorhexidine, Triclosan, or bromochlorophene may be employed, as well as other known agents. A wide variety of medicaments effective to destroy bacteria and fungus may be employed, both for the purpose of preventing bacterial/fungus growth on the brush and to deliver such ingredients into the oral cavity.

As for disinfectants/antibacterials, others that could be included are:

- Hexetidine
- Phenols in general
- Trichlorophenyl
- Formaldehyde
- Quaternary Ammonium compounds (e.g. Benzalkonium Chloride)
- Pyridine Derivatives (e.g. Cetylpyridinium chloride)
- Hexachlorophane

Indeed, although the toothbrush of the present invention is well-suited for conventional brushing with a dentifrice, it may be used without the latter and thus be employed as a means of delivering suitable medications into the oral cavity.

According to the invention the anchor 17 - which is usually metal such as nickel-silver, brass, aluminum, etc.- is coated with the disinfectant and/or antibacterial/fungus agents described above.

More particularly, a water-swellaable coating, or a coating capable of releasing the above agent(s) in concentrations sufficient to achieve the disinfecting and medicinal purposes described when wet, is applied to the metal. For example, the metal anchors are usually derived from a continuous spool of the metal(s) mentioned above and are passed to the tufting machine and cut to size in situ. The coating material may be, for example, a polyvinyl or similar polymer capable of forming a film, e.g., cast from alcohol. The coating can be applied to the spool of metal at the source of manufacture or just prior to the tufting process via a coating bath

or spray. To retain sufficient material, a groove may be formed on one or both sides of the metal anchor to hold the coating material.

A variation of the above is to form the metal anchor in two or more strips (not shown) and to apply the coating as a "sandwich" between two of the strips.

Further, the anchor can be made of high strength plastic which then can be coated with the agent(s) described above.

## Claims

1. A toothbrush comprising a brush head having a plurality of tuft holes (15, 16) for the reception and retention of respective multiplicities of bristles (13) in the tuft holes, each multiplicity of bristles being attached in a corresponding tuft hole by a corresponding anchor (17), and at least one of said tuft holes containing therein an agent releasing material which contains and slowly releases the agent during repeated brushings, the release of the agent being activated by contact of the agent releasing material with liquid during brushing, said agent being selected from the group consisting of disinfectants and medications, characterized in that said agent releasing material is applied as a coating on the surface of the anchor in said at least one tuft hole prior to insertion of the anchor inside said at least one tuft hole.
2. A method of manufacturing a toothbrush comprising the step of forming a brush head with a plurality of tuft holes (15, 16), characterized by the further steps of coating the surface of an anchor (17) with an agent selected from the group consisting of disinfectants, medications and mixtures thereof and anchoring a plurality of bristles (13) in one of said plurality of tuft holes by inserting said coated anchor therein.

## Patentansprüche

1. Zahnbürste mit einem Bürstenkopf, der eine Vielzahl von Büschellochern (15, 16) zum Aufnehmen und Festhalten einer jeweiligen Multiplizität von Borsten (13) in den Büschellochern aufweist, wobei jede Borstenmultiplizität in einem entsprechenden Büschelloch durch eine entsprechende Halterung (17) befestigt ist, und mindestens eines dieser Büschellocher darin ein agensfreisetzendes Material enthält, welches das Agens enthält und während wiederholten Bürstens freisetzt, wobei das Freisetzen des Agens durch Kontakt des agensfreisetzenden Materials mit Flüssigkeit während des Bürstens aktiviert wird, wobei das Agens ausge-

wählt ist aus der Gruppe bestehend aus Desinfektionsmitteln und Arzneistoffbeimischungen, **dadurch gekennzeichnet**, daß das agensfreisetzende Material als eine Beschichtung auf die Oberfläche der Halterung in diesem mindestens einen Büschelloch vor Einsetzen der Halterung ins Innere dieses mindestens einen Büschellochs aufgebracht wird.

2. Verfahren zum Herstellen einer Zahnbürste einschließlich der Stufe des Bildens eines Bürstenkopfs mit einer Vielzahl von Büschellochern (15, 16), **gekennzeichnet** durch die weiteren Stufen des Beschichtens der Oberfläche einer Halterung (17) mit einem Agens ausgewählt aus der Gruppe bestehend aus Desinfektionsmitteln, Arzneimittelbeimischungen und Mischungen derselben und Verankern einer Vielzahl von Büscheln (13) in einem dieser Vielzahl von Büschellochern, indem man die beschichtete Halterung darin einsetzt.

## Revendications

1. Brosse à dents comprenant une tête de brosse ayant plusieurs trous (15, 16) de touffe destinés à loger et retenir des ensembles respectifs de soies (13) dans les trous de touffe, chaque ensemble de soies étant fixé dans un trou correspondant de touffe par un organe correspondant d'ancrage (17), et l'un des trous de touffe au moins contenant un matériau capable de libérer un agent et qui contient et libère lentement l'agent au cours de brossages répétés, la libération de l'agent étant activée par contact du matériau de libération de l'agent avec un liquide au cours du brossage, l'agent étant choisi dans le groupe qui comprend les agents désinfectants et les agents médicamenteux, caractérisée en ce que le matériau destiné à libérer l'agent est appliqué sous forme d'un revêtement à la surface de l'organe d'ancrage placé dans au moins un trou de touffe avant l'introduction de l'organe d'ancrage à l'intérieur de ce trou de touffe au moins.
2. Procédé de fabrication d'une brosse à dents, comprenant une étape de formation d'une tête de brosse avec plusieurs trous (15, 16) de touffe, caractérisé par les étapes supplémentaires de revêtement de la surface d'un organe d'ancrage (17) par un agent choisi dans le groupe qui comprend les agents désinfectants, les agents médicamenteux et leurs mélanges, et d'ancrage de plusieurs soies (13) dans l'un des trous de touffe par insertion de l'organe revêtu d'ancrage dans le trou.

