

[54] **DENTAL SHIELDING DEVICE**

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[58] Field of Search 128/271; 32/33

[56] **References Cited**

UNITED STATES PATENTS

2,859,519 11/1958 Cohn 32/33

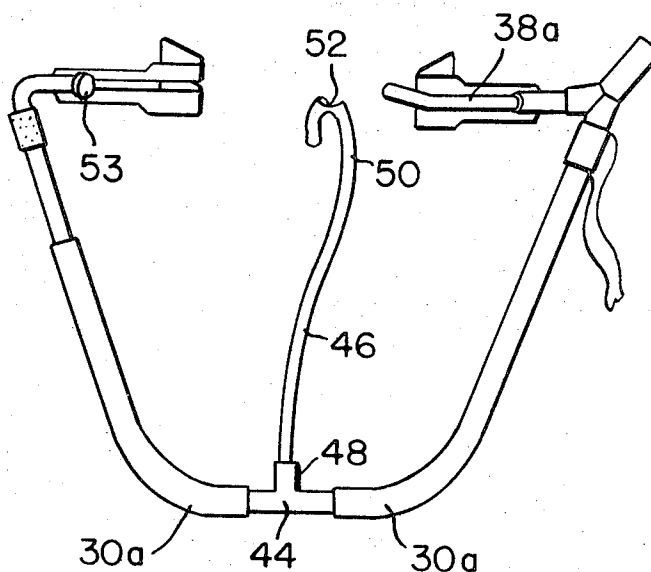
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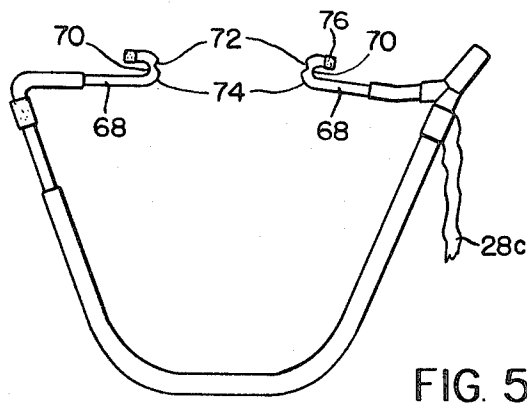
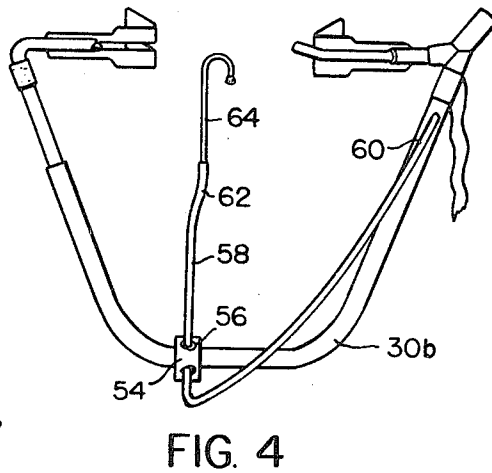
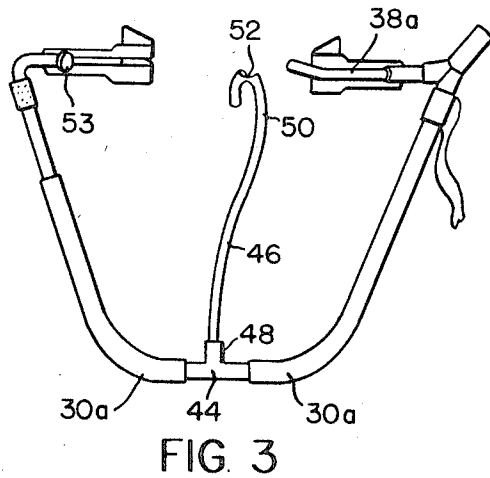
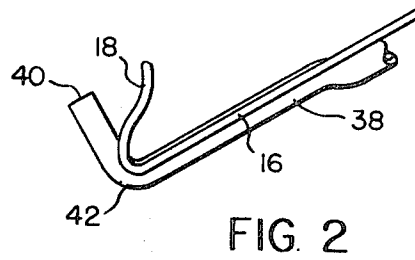
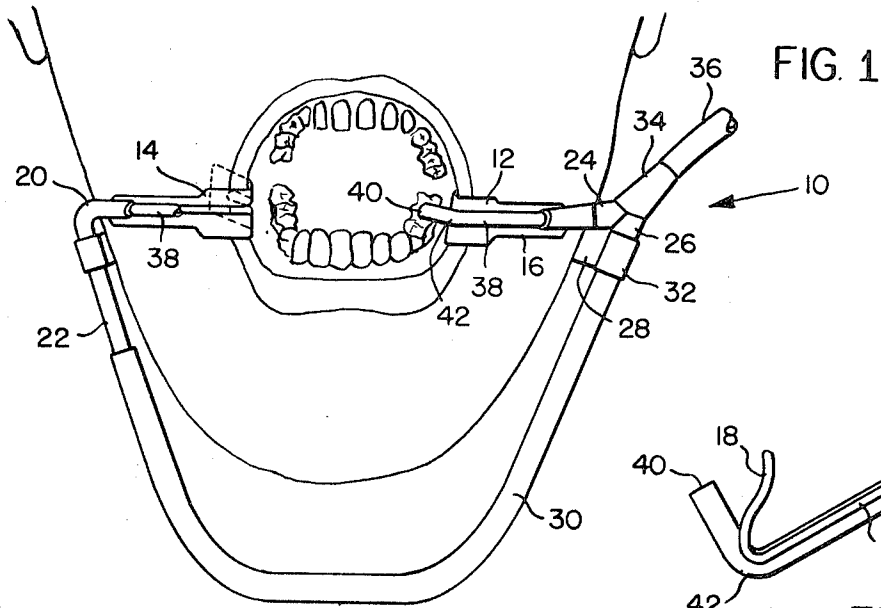
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[57] **ABSTRACT**

A dental device positionable about the head of the patient for protecting dental personnel during a dental procedure. The device includes a cheek retractor, means for tensing the cheek retractor, and reusable or disposable aspirator tubes carried by the cheek retractor. The aspirating tubes each have an orifice directed into the mouth of the patient with the other end of the tubes being connected to a vacuum source. With this arrangement, odors, aerosols and the like, such as finely divided tooth or filling material which are generated in the mouth during a dental procedure, are carried away by the aspirator tubes and are prevented from being discharged into the air towards the doctor. In another embodiment the tubes themselves function as cheek retractors.

10 Claims, 5 Drawing Figures





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DENTAL SHIELDING DEVICE

BACKGROUND OF THE INVENTION

The present invention relates generally to means for preventing the discharge of finely divided air-borne tooth material, aerosols and the like and the exudation of odors from the mouth of a patient during a dental operation; and more specifically, to such a device in combination with a cheek retractor.

It is well known in the art that dentists are especially susceptible to respiratory illnesses and vulnerable to eye infections and damage. This is partly because the head of the dentist is very close to the mouth of the patient during the dental operation so that the dentist's face is well exposed to any pathogenic micro-organisms discharged from the mouth of the patient. Also, when the dentist uses a high-speed drill to prepare a tooth for filling, the drilling operation produces finely divided tooth material such as enamel or dentin and other aerosols such as oil droplets from the lubricating mechanism of the drill, water sprays, and possibly mercury vapor in the case where an amalgam filling is being removed. These materials are usually discharged from the patient's mouth generally in a direct line with the dentist's face. All these materials may be inhaled by the dentist which also increase the likelihood of respiratory illnesses. These materials may also impinge on the eyes causing eye infections and the like.

To reduce the likelihood of inhaling such substances, some dentists have taken to wearing surgical masks. However, the mask itself may be uncomfortable and the sight of a surgeon's mask could unnerve a sensitive patient. Besides, no practical face mask can effectively filter aerosol particles $\frac{1}{2}$ to 10 microns in diameter. These are particularly dangerous as they are suitable vehicles for pathogens, and can float around the operator for many hours, endangering all its occupants.

Apparatus has also been developed which creates an "air curtain" between the dentist and his patient. In such apparatus, as shown for example in U.S. Pat. No. 3,537,447, a stream of air is blown across the mouth of the patient with sufficient velocity to prevent the passage through the air stream of the aerosols and the like expelled from the patient's mouth. Such devices, however, must be placed in front of the patient's mouth and compromises the freedom of movement of the dentist. These devices also remedy only part of the problem in that the aerosols, once expelled from the patient's mouth could pass around the air stream. Also, as the dental procedure may involve passage of the dentist's hands through the air stream, its screening effect is seriously compromised.

The use of high velocity air suction with an evacuator tip held adjacent the aerosol-generating instrument by an assistant, or by using a suction tip placed in the patient's mouth has been shown by study to reduce the bacterial aerosols escaping from the mouth. One such study is reported in Journal of Dental Research, Vol. 48, No. 1, January-February 1969 on pages 49-56.

SUMMARY OF THE PRESENT INVENTION

The present invention utilizes an aspirator tube positioned at the corner of the patient's mouth with one end of the tube being directed into the mouth. Preferably, two aspirator tubes are used; one positioned at each corner of the mouth with the tubes being held in place by a cheek retractor which is adjustable about the

head of the patient. The aspirator tubes and cheek retractors present a low profile and lie along side of the face of the patient so as to interfere as little as possible with the dental procedure. Alternatively, the aspirator tubes themselves when properly configured, can act as cheek retractors. The aspirator tubes being directed into the mouth produce a high vacuum field within the oral cavity to provide direct aspiration of all odors, mists, and loose and light particles in the oral cavity especially aerosols and aerosol borne particles. Also, producing a vacuum field within the oral cavity sets up a potent secondary effect consisting of a healthy stream of outside air being drawn into the patient's mouth. This stream of air entering the mouth effectively intercepts any of the outgoing particles which may have temporarily escaped the direct suction of the aspirator and forces these particles back into the oral cavity for quick removal by the aspirator tubes. Preferably the aspirator tubes are detachably attachable to the cheek retractor to permit disposal after use.

In another embodiment of the invention, provision is made for locating a second aspirator tube over the patient's mandible should one of the tubes located at either corner of the mouth interfere with the dental procedure. In still another embodiment, the tubes themselves function as the cheek retractors and in still another, provision is made for incorporating a saliva ejector with the aspirator tubes and cheek retractors.

OBJECTS OF THE INVENTION

One object of the present invention is to provide an inexpensive effective means for preventing the discharge of aerosols and the like from the mouth of the patient during a dental procedure.

Another object of the present invention is to provide means for retracting the cheeks of the patient and preventing discharge of aerosols and the like from the patient's mouth.

A further object of the present invention is to provide in combination with a cheek retractor, disposable means for creating a high vacuum field within the oral cavity for direct aspiration of aerosols and aerosol borne materials from the mouth of the patient wherein the stream of outside air entering the patient's mouth to fill the vacuum intercepts any outgoing particles which may have initially escaped aspiration.

Still another object of the present invention is to provide means for producing a high vacuum field within the oral cavity of the patient which is attachable about the patient's head and lies along side his face so as to not interfere with the dental procedure.

These and other objects, advantages and characterizing features of the present invention will become more apparent upon consideration of the following description thereof when taken in connection with the accompanying drawings depicting the same.

DESCRIPTION OF THE DRAWINGS

FIG. 1 is a view of the apparatus in place about the head of the patient with one of the aspirator tubes being broken away;

FIG. 2 is a cross-sectional view of a section of the cheek retractor and aspirator tube;

FIG. 3 is a view similar to FIG. 1 showing another embodiment of the invention;

FIG. 4 shows still another embodiment of the invention;

FIG. 5 shows the dual purpose aspirator tip and retractors.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring to the drawings, FIG. 1 shows the device of the present invention generally indicated at 10 in place about the head of a patient. The device includes a pair of cheek retractors 12 and 14, one for each side of the patient's mouth. Each retractor member includes a flat bifurcate body portion 16, terminating in inwardly and rearwardly turned prongs 18 (FIG. 2). Body portion 16 is adapted to lie flush against the outside of the patient's cheek and the prongs hook the orbicularis oris at each corner of the patient's mouth.

Retracting member 14 is attached to the base leg 20 of a generally L-shaped, fitting 22. The other retracting member 12 is attached to one branch 24 of a Y-fitting 26. Fittings 22 and 26 are connected by an elastic strap 28 or other suitable tensioning means which passes around the back of the patient's head. The amount of cheek retraction may be adjusted by adjusting the tension of strap 28.

Fitting 22 is connected to another branch 32 of the Y-fitting by a flexible tube 30 and the base leg or common branch 34 of the Y-fitting is connected by a line 36 to a high volume evacuator, not shown. Flexible tube 30 passes generally beneath the chin of the patient and is sufficiently flexible so that the device may be used for wide ranges of sizes and shapes of patient's faces.

Releasably inserted into both the base leg 20 of L-fitting 22 and branch 24 of the Y-fitting are aspirator tubes 38. Tubes 38 lie between the prongs of the bifurcate cheek retractors in order to maintain the profile, as shown in FIG. 2, as low as possible. Each aspirator tube has a single orifice opening 40 defining one end of the aspirator tube, and a bent portion 42 to position the orifice within the patient's mouth. The angle of the bend ideally directs the orifice 40 of the aspirator tube towards the geometric center of the patient's mouth. However, the connection of the aspirator tubes to fittings 22 and 26 is such that the tubes may be swiveled up or down approximately $\pm 45^\circ$ as desired to suit the operating conditions.

As shown in FIG. 1, positioning the aspirator tubes at each corner of the patient's mouth locates the bent portion 42 and orifice 40 of each tube between the planes defined by the biting surfaces of the upper and lower teeth. With this arrangement, there is an unobstructed path directly into orifice 40 and flow into the orifice is not blocked or hindered by having the orifice disposed against the gum line or tooth surface.

In operation, cheek retractors 12 and 14 are simply put in position and the elastic band 28 connected around the back of the patient's head. The high volume evacuator (not shown) is turned on so that aspirator tubes 38 draw a vacuum in the oral cavity. With this arrangement any free floating material such as tooth debris, lubricating oil drops, pulverized amalgam, vaporized mercury, water mist and the like which are created during the dental procedure as well as all mouth odors are sucked through orifice 40 and into aspirator tubes 38. In addition, the drawing of a partial vacuum within the oral cavity causes an inrush of air into the patient's mouth which acts effectively to intercept any outgoing particles which may have temporarily escaped the di-

rect suction of the aspirator tubes and in this manner prevents the discharge of aerosols and the like from the mouth of the patient.

In order to maximize the combined effects of direct aspiration and the interception of outgoing particles by inrushing air, it has been found that orifices 40 should be positioned about $\frac{1}{2}$ inch into the oral cavity. In this respect, direct aspiration may diminish as orifice 40 is moved farther into the oral cavity away from the work area and the suppression effect of the inrushing air may diminish as the orifice is moved farther out of the oral cavity.

In tests conducted on a mannequin, debris and aerosols created by high speed drilling were simulated by blowing a mixture of air and talcum powder into the oral cavity of the mannequin at various input flows over a range of about 1.85 to 3.35 SCFM. The output flow created by the high volume evacuator was adjusted in each case until no talcum powder could be observed leaving the mouth of the mannequin. It was found that with aspirator tubes having an internal diameter of about $\frac{1}{4}$ in., no talcum powder could be observed leaving the mouth of the mannequin when utilizing output flows of between 4 and 8 SCFM for input flows of 1.85 and 3.35 SCFM respectively. While other diameter tubing may be used, the aerosol suppressing effectiveness for a given vacuum setting decreases as the internal diameter of the tube decreases and tubes of larger diameter tend to interfere with the dental procedure. Also, the tubes may be made of any suitable material such as metal but plastic is preferred both for patient comfort and for making the tube disposable.

DESCRIPTION OF OTHER EMBODIMENTS

In describing other embodiments of the invention, the same reference numeral with a letter prefix is used to denote like structure.

In the event the location of an aspirator tube at either corner of the patient's mouth would interfere with the operating procedure, provision is made in the embodiment of FIG. 3 for the relocation of one of the aspirator tubes. In this respect and with reference to FIG. 3, flexible tube 30 (a) is bisected and the two sections joined by two legs of a T-fitting 44. An aspirator tube 46 is then detachably attached to the third leg 48 of the T-fitting. Aspirator tube 46 has a bent end 50 positionable over the mandible of the patient. An orifice 52 in end 50 is designed to create a vacuum field directed towards the geometric center of the mouth. In this embodiment either one or the other of aspirator tubes 38 (a) may be removed from its respective fitting and the fitting closed off with a removable plug 53 shown inserted into the L-fitting. The removed aspirator tube is thus replaced by the central aspirator tube 46 without materially reducing the aerosol suppressing action of tubes located at each side of the patient's mouth.

In the embodiment shown in FIG. 4, provision is made for incorporating a saliva ejector into the design of the device. In this respect, a slip-ring 54 is slidably positioned on flexible tube 30 (b). The slip-ring is provided with a passage 56 which fractionally embraces a flexible saliva ejector tube 58. One end 60 of the saliva ejector tube communicates with flexible tube 30 (b) adjacent the Y-fitting and the other end 62 of the ejector tube is attached to a standard saliva ejector 64. The slip-ring 54 permits lateral adjustment of the saliva ejector tube along flexible tube 30 (b) while passage 56

permits vertical movement of the saliva ejector to adjust the downward force of the ejector tip on the lingual surface of the mandible. This latter motion is accomplished simply by sliding the flexible saliva ejector tube within passage 56.

In the embodiment shown in FIG. 5, the aspirating tubes at each corner of the patient's mouth also act as cheek retractors. As shown in FIG. 5 each aspirator tube 68 has an end 70 bent inward and rearward to form a hook which grasps the corner of the patient's mouth for retracting the cheeks. An orifice 72 is provided at the bend 74 of each tube, the orifice opening generally towards the geometric center of the patient's mouth. Any suitable soft member 76 may incase the extreme ends of the tubes or the tube ends may be rounded to prevent injury to the interior of the patient's mouth caused by tension exerted by elastic band 28 (c).

Having thus described the invention it should be appreciated that the present invention accomplishes its intended objects, in providing a sufficiently inexpensive apparatus for suppressing the discharge of aerosol borne material from the mouth of the dental patient. The use of cheek retractors either separately, or as part of the aspirating tube provides a dual function of firmly anchoring the device in place while retracting the cheeks of the patient to afford the dentist an unobstructed field of view. One or more components of the device such as the cheek retractors and/or the aspirating tubes may be disposable items which would add to efficiency in that the items could be discarded after use and would not have to be sterilized for reuse.

Having thus described the invention in detail what is claimed as new is:

1. A device for preventing egress of aerosols and the like from the mouth of a dental patient comprising:
 - a. a cheek retractor; and
 - b. aspirator means on said cheek retractor having a single orifice opening located in the patient's mouth between the planes defined by the biting surfaces of the upper and lower teeth and directed generally towards the geometric center of the oral cavity of the patient.
2. A device as set forth in claim 1 wherein said aspirator means comprises:
 - a. a tube member, said single orifice defining a first end of said tube member;
 - b. said tube member being adapted to lie along the outside of the patient's cheek and having a bent portion including said first end for positioning said single orifice within the patient's mouth between the biting surfaces of the upper and lower teeth when the mouth is open and directing said single orifice generally towards the geometric center of the oral cavity; and
 - c. means connecting the second end of said tube member to a vacuum source.
3. A device as set forth in claim 2 wherein said tube member bent portion comprises said cheek retractor.
4. A device as set forth in claim 2 wherein said cheek

retractor is bifurcate with said tube member being carried by said cheek retractor between the prongs thereof.

5. A device as set forth in claim 2 comprising:
 - a. a pair of said tube members, one for each corner of the patient's mouth; and
 - b. adjustable means connecting said tube members and passing around the back of the patient's head.
6. A device for preventing egress of aerosols and the like from the mouth of a dental patient comprising:
 - a. a pair of aspirator tubes each adapted to lie along the outside of a patient's cheek;
 - b. each aspirator tube having a single orifice defining a first end of said tube, a portion of said end being bent to position said orifice in the patient's mouth between the planes formed by the biting surfaces of the upper and lower teeth and directed generally towards the geometric center of the oral cavity;
 - c. said aspirator tube bent portions forming cheek retractor means adapted to hook each corner of the patient's mouth;
 - d. tensioning means for attaching said aspirator tubes to the patient; and
 - e. means for attaching the second end of each aspirator tube to a vacuum source for drawing aerosols and aerosol bore particles created in the mouth of the patient during a dental procedure directly into said orifice, whereby discharge of such aerosols from the mouth of the patient is prevented.
7. A device as set forth in claim 6 wherein said last mentioned means comprises:
 - a. a Y-fitting having a first branch in releasible communication with the second end of one of said aspirator tubes, a common branch communicating with said vacuum source, and a second branch, said Y-fitting being adjacent one of said aspirator tubes; and
 - b. a flexible tube for connecting said second Y-fitting branch to the other of said aspirator tubes, said flexible tube being adapted to pass generally beneath the chin of the patient.
8. A device as set forth in claim 7 wherein:
 - a. said flexible tube comprises two sections joined with a T-fitting; and
 - b. one of said aspirator tubes being connected to the third leg of said T-fitting, said tube having its bent portion positionable over the mandible of the patient and an orifice in said bent portion opening generally towards the center of the oral cavity.
9. A device as set forth in claim 7 comprising:
 - a. a saliva ejector positionable over the mandible of the patient; and
 - b. a flexible saliva ejector line connecting said saliva ejector to said flexible tube, said line having a smaller diameter than said tube.
10. A device as set forth in claim 9 comprising a slipping slidably positioned over said tube, said ring frictionally engaging said line to permit adjustment of the tension on said flexible saliva ejector line.

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