

[54] DENTAL TOOL

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[58] Field of Search..... 51/206, 206 P; 32/58, 59

[56]

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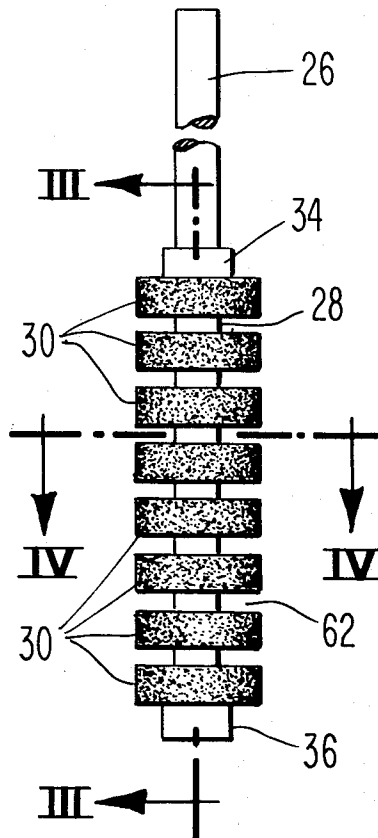
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[57]

ABSTRACT

A novel dental tool for use with dental handpieces is described as facilitating the rapid removal of dental enamel and other tooth material preferably by first abrading followed by then chipping. The dental tool of the present invention preferably features a plurality of spaced apart chipping rings disposed along a shaft. Each of the rings increases in thickness from a minimum at or close to the shaft to a maximum at the peripheral edge or farther from the shaft. Several alternate embodiments include tools having various peripheral shapes and coatings.

13 Claims, 8 Drawing Figures



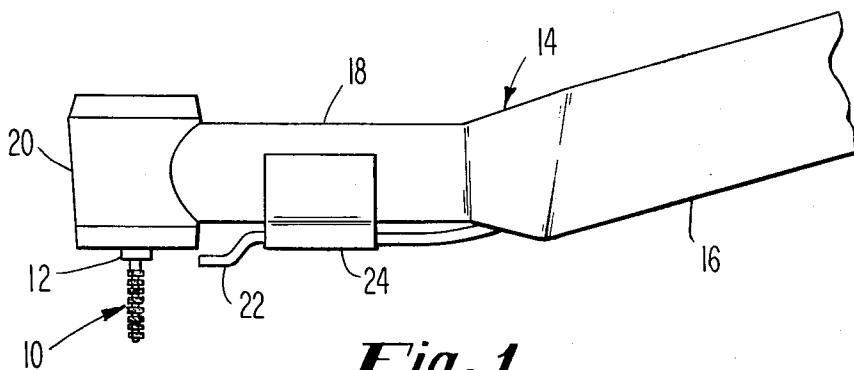


Fig. 1

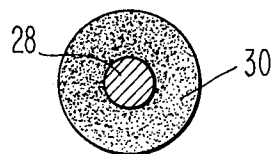


Fig. 4

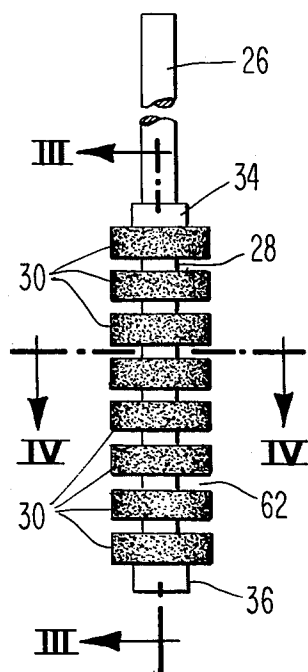


Fig. 2

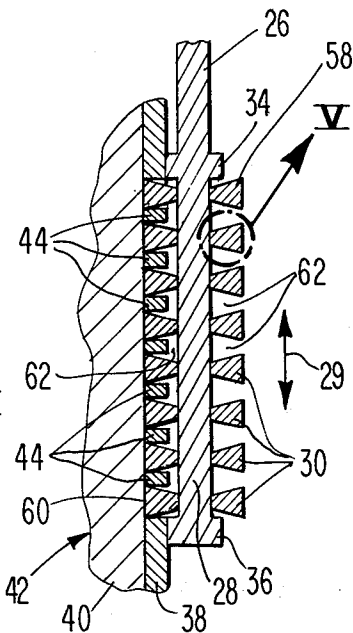


Fig. 3

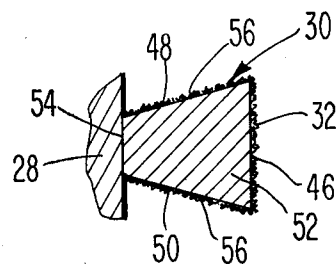


Fig. 5

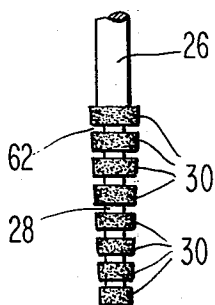


Fig. 6

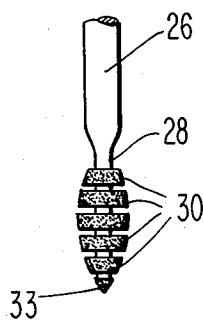


Fig. 7

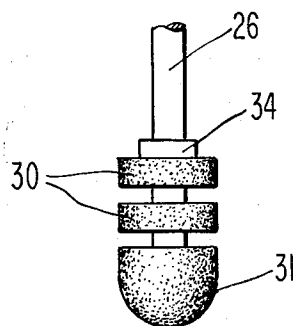


Fig. 8

DENTAL TOOL

BACKGROUND OF THE INVENTION

Modern denistry has developed a number of types of dental tools which are designed to be fitted into the chuck of a dental handpiece for the purpose of grinding away or otherwise abrading tooth material. These instruments generally comprise a shank which is directly friction fitted into the chuck of the handpiece and a grinding portion attached to the shank. These grinding portions are normally available in a wide variety of geometric configurations and are usually provided with an abrasive coating such as a diamond or other suitable grit. Common geometric configurations of the grinding portion of the tool are straight and tapered cylinders, cones, inverted cones, balls, flat and round edged wheels, grooved wheels, and spiral grooved tapered cylinders.

During the course of a normal dental procedure, it may be necessary to use many tools of various sizes and shapes to grind away the required amount of tooth material. In certain instances, such as in the capping of teeth, it is necessary to remove large amounts of dental enamel. More recently, high speed drills have become available for quickly grinding away large amounts of enamel and other tooth material, however notwithstanding this advance, certain dental operations still require prolonged grinding operations which are, at best, fatiguing for both dentist and patient.

The grinding away of large amounts of tooth material, particularly using high speed drills, coincidentally generates a considerable amount of heat, which, if uncontrolled, may result in the injury of tooth pulp tissue. Additionally, the effectiveness of the abrasive coating on the dental tool may become impaired by the accumulation of powdered tooth material on the abrasive surface. In order to minimize these difficulties, jets of air and/or water are often directed at the grinding tool for the purpose of dissipating heat and powdered tooth material. Nonetheless, the speed with which tooth material may safely be removed is still limited, resulting in the need for lengthy and fatiguing grinding sessions during the performance of certain dental procedures.

SUMMARY OF THE INVENTION

The present invention provides a novel dental tool having a plurality of rings disposed in sequential spaced apart relation along a central shaft.

A primary object of the present invention is the provision of a dental tool which can remove large amounts of tooth material by first grinding into the surface of the tooth, and then chipping away the remaining tooth material.

Another object of the present invention is to provide a tool which minimizes the heat build-up generated by the rapid removal of tooth material.

A further object of the present invention is the provision of a dental tool which is non-clogging and quickly dissipates large amounts of tooth debris.

Another aim of the present invention is the provision of a tool which maximizes the dissipation of heat, resulting from the grinding and chipping of tooth material.

These and other objects of the present invention will become apparent from the following description of the present invention.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 shows a side view of a conventional dental handpiece which is fitted with the cylindrical form of the dental tool of the present invention;

FIG. 2 is an enlarged side view of the cylindrical embodiment of the dental tool of the present invention;

FIG. 3 is a cross section taken along the line III—III of the dental tool of FIG. 2 shown with a fragmentary diagrammatic representation of a tooth;

FIG. 4 is a cross section taken along the line IV—IV of the dental tool of FIG. 2;

FIG. 5 is an enlarged fragmentary cross section of the portion of FIG. 3 designated by the numeral V;

FIG. 6 is an enlarged side view of the tapered cylindrical embodiment of the dental tool of the present invention;

FIG. 7 is an enlarged side view of the spheroidal embodiment of the present invention; and

FIG. 8 is an enlarged side view of the hemispheroidal tipped cylindrical embodiment of the present invention.

DETAILED DESCRIPTION OF THE DRAWINGS

Although specific forms of the invention have been selected for illustration in the drawings, and the following description is drawn in specific terms for the purpose of describing these forms of the invention, this description is not intended to limit the scope of the invention which is defined in the appended claims.

As can be seen in FIG. 1, the present invention relates to a dental tool designated generally 10 which engages the chuck 12 of a standard dental handpiece designated generally 14. Although the handpiece shown is a high speed air turbine contra-angle handpiece, the dental tool of the present invention may be used with any of the standard handpieces known to the art including but not limited to straight handpieces such as those of the belt driven and more recently, of the air turbine driven types. The handpiece 14 comprises a handpiece body 16, a handpiece neck 18, and a handpiece head 20. A pair of parallel fluid jets 22 are shown attached to the handpiece neck 18 by a bracket 24. The purpose of the fluid jets is to direct streams of fluid (generally air and water) upon the dental tool then engaged by the chuck 12 for the purpose of dissipating heat and flushing away powdered tooth material during the operation of the tool. Referring now to FIG. 2, the dental tool of the present invention comprises a shank 26, a shaft or post 28 connected to or forming a part of the shank 26, and a plurality of coaxial rings sequentially disposed along the shaft and having a maximum thickness at their periphery. Although a standard diameter (approximately 0.032 inches) friction grip shank is illustrated in FIG. 1, it is anticipated that various other shank diameters may be provided depending, for example, upon the type of handpiece to be utilized.

FIG. 3 shows a cross section of the tool of FIG. 2 in relationship to a fragmentary portion of a tooth designated generally 42. The tooth is shown comprising a surface layer 38 and a tooth substrate 40. In many instances, the surface layer 38 to be removed may correspond with the enamel surface layer of a normal tooth. In other instances, this surface layer 38 will be composed of the same material as the tooth substrate 40. The representation of the surface layer 38 in FIG. 3 is meant only to illustrate that this portion or layer of

tooth material has been selected for removal in accordance with the present description.

The tool of the illustrated embodiment is operated initially at the desired speed (rpm) by grinding into the surface layer 38 under pressure applied substantially transverse to the axis of the shaft 28. In order to prevent the removal of the tooth substrate 40, each of the various embodiments of the tool may be provided with one or more stops which prevent the tool from grinding too deeply into the tooth. This is particularly desirable in conjunction with the development of the proper manipulative technique, as in training at dental schools. An annular gingival stop 34 is shown disposed between the rings 30 and the shank 26. An annular insisal stop 36 is shown disposed on the end of the shaft 28 which is remote from the shank 26. Normally, these stops will have a radius of between $\frac{1}{2}$ and 1 millimeter less than the radius of its adjacent rings, as measured from the center axis of the shaft 28. The stops 34, 36 may, if desired, be separate and applied as by press-fitting onto the shaft 28, or may be constructed integrally therewith, as desired. However, their outer diameter will generally be somewhat less than the outer diameter of the rings by twice the desired depth of penetration of the rings into the tooth.

The cylindrical embodiment shown in FIG. 3 is located in the position in which the tool has ground to the maximum depth permitted by the stops and is now limited by the engagement of stops 34 and 36 with the surface layer 38 to be removed. The surface layer to be removed has been grooved by the tool leaving a plurality of surface layer ridges which are now removed by reciprocating the tool in a direction along the axis of a shaft and shown by the double headed arrow in FIG. 3. This axial movement of the tool chips out the remaining surface layer ridges 44 thereby removing a considerable portion of the surface layer 38 of the tooth without the additional grinding which would be required with conventional dental tools.

Rapid chipping action is accomplished by the unique formation of each of the plurality of rings 30. FIG. 5, which is an enlarged cross-sectional view of one of the rings and a fragmentary portion of the shaft 28, shows that each of the rings, designated generally 30, comprises a core 52 forming a peripheral surface 46, an upper inner surface 48, and a lower inner surface 50. The core, which is formed from high carbon steel or other suitable materials, may be formed from a similar material which forms the shaft 28, if desired. Moreover, while the members 30 are referred to as rings and would normally be press-fit onto shaft 28, it is conceivable that they could be formed integrally with the shaft 28, or otherwise, as for example in segments of rings, but in any event will be ring-like in appearance. The peripheral surface 46 should be covered with an abrasive coating 32 to facilitate the grinding operation which is characteristic of the first step in the use of the tool. As seen in FIG. 5, the rings 30 have a maximum thickness at the peripheral surface 46 and a minimum thickness at its radial innermost portion, namely at its junction 54 with the shaft 28. After the tool has ground into the surface layer 38 of the tooth 42, the upper and lower inner surfaces 48 and 50 effect a chipping action on the remaining surface layer ridges 44 by exerting forces directed as shown by the double-headed arrow 29 in FIG. 3 substantially at the bases of those ridges. In order to increase the effectiveness of this chipping action the

inner surfaces 48 and 50 may be covered by an inner surface abrasive coating similar to the abrasive coating 32 covering the peripheral surface 46. This abrasive coating is particularly important on the upper surface of the first ring 58 and on the lower surface of the last ring 60, for these inner surfaces engage portions of the surface layer 38 of the tooth which are less likely to chip away merely due to transverse pressure. The inner surface abrasive coating will tend to undercut the surface layer ridges during the axial reciprocation of the tool. The location of this force at the base of the ridges 44 results in a clean chipping action of the tooth material of the surface layer ridges 44. The abrasive coating 32 of the peripheral surface 46 grinds away any remaining high spots left by uneven chipping of the ridges. Although the inner surfaces 48 and 50 are shown to have a linear cross section, it is anticipated that concave or other parabolic configurations which result in a maximum thickness at the peripheral surface would function effectively, however a linear surface is preferred because of relative simplicity in manufacture and because of the need of the rings or ring-like members to have sufficient strength to withstand repeated uses under applied chipping forces.

Due to the wide variety of tooth surface configurations, the present invention may be embodied in a number of different shapes of tools. In addition to the cylindrical embodiment shown in FIG. 2, the drawings represent a tapered cylindrical embodiment (FIG. 6), a spheroidal or ellipsoid-like embodiment (FIG. 7) the ring-like members of which have in radial cross-section, a curved peripheral surface, and a hemispheroidal-tipped cylindrical embodiment (FIG. 8). The hemispheroidal-tipped cylindrical embodiment combines the advantages of the present invention with a hemispheroidal grinding surface 31 which may be used in a standard manner. Similarly, the tipped ring 33 of the ellipsoid-like embodiment of FIG. 7 may also be used in conventional grinding manner. Each of these embodiments like the embodiment of FIG. 2 employs circular ring members and in appropriate cases employs circular end members 31, 33, all of which, in use are working members of the circular configuration illustrated for example in FIG. 4. Also, each of the embodiments may similarly employ appropriate gingival or incisal stops or even other stops located, for example, between a pair of adjacent chipping rings anywhere along the shaft 28, as desired, not shown in the drawings, and may be provided with abrasive coating on the inner surfaces as well as the peripheral surfaces of the rings.

It will be noted that, regardless of the configuration of the tool, i.e., cylindrical as in FIG. 2, frusto-conical as in FIG. 6, or spheroidal as in FIG. 7, or otherwise, the ring-like members of the tool, when viewed in radial cross-section as in FIG. 5, preferably have upper and lower surfaces 48, 50 each of which defines an acute angle at its intersection with the peripheral surface 46. A ring surface so forming an acute angle is herein referred to as being "undercut".

The number of rings disposed along the shaft may vary according to the limits of accessibility to the tooth surfaces within a patient's mouth. The preferred embodiments of the present invention comprise between three and eight rings. Where the tooth surface to be removed is readily accessible, six to eight rings is generally preferred.

The novel structure of each of the embodiments of the present invention not only facilitates a rapid grinding and chipping action of tooth material but also minimizes the resultant heat build up during any given operation since the chipping action employed produces less heat than that created by grinding away a similar amount of tooth material. In addition to reducing the amount of heat produced, the present invention acts to better dissipate that heat which is created by providing sluice ways 62 formed between adjacent rings which act to provide additional surface area to allow the fluid directed by fluid jets 22 to cool the tool 10 and tooth 42. This sluice ways 62 are particularly important in allowing the fluid from the fluid jets 22 to carry away debris during the reciprocating chipping stage in the operation of the tool. Therefore, with the tool of the present invention greater amounts of tooth material may be removed at lower operating temperatures than corresponding conventional tools operating at similar speeds. Particularly, use of the tool in high speed handpieces facilitates the rapid removal of tooth material thereby affecting a great savings of time and effort on the part of all concerned.

It will be understood that various changes in the details, materials and arrangement of parts which have been herein described and illustrated in order to explain the nature of this invention may be made by those skilled in the art within the principle and scope of the invention as expressed in the following claims.

What is claimed is:

1. A dental tool for use with a dental handpiece and having multiple spaced apart working members comprising:

- a. a shank for engaging a chuck of a dental handpiece;
- b. a post extending axially of said shank;
- c. a plurality of coaxial circular working members sequentially disposed along said post, said working members being in spaced apart relation relative to each other; and
- d. an abrasive covering at least a portion of the surfaces of said circular working members,

wherein adjacent ones of said circular working members define annular voids therebetween, with the circular members on opposite sides of the annular voids having surfaces that are undercut between said post and peripheral surfaces of the members such that the axial distance across each said annular void between opposite undercut surfaces decreases from a maximum at the post to a minimum at an associated said peripheral surface, wherein said abrasive appears on all exposed working surfaces of the circular members, wherein there are a sufficient number of said circular members so that there are provided at least three said peripheral surfaces, and wherein said three peripheral surfaces and the undercut surfaces respectively comprise means whereby the tool may be used to first grind into a tooth in at least three spaced apart locations determined by the spaced apart peripheral surfaces of the working members, leaving at least a plurality of intermediate tooth portions, and then be used to chip away the controlled tooth amount comprising the plurality of intermediate tooth portions, by axial movement of the tool

in a back-and-forth motion for said undercut surfaces of the working members to engage and undercut the intermediate tooth portions under conditions of controlled chipping.

2. The tool of claim 1, wherein said tool is provided with stop means for limiting the depth of penetration of said circular working members into a tooth during use, to a predetermined depth of penetration.

3. The tool of claim 2, wherein said stop means comprises an annular gingival stop of non-abrasive material, having its periphery radially disposed between the periphery of at least one of said circular working members and said shank.

4. The tool of claim 3, wherein said gingival stop has a radius between one-half millimeter and one millimeter less than the radius of its adjacent circular working member.

5. The tool of claim 2, wherein said stop means comprises an annular incisal stop of non-abrasive material disposed on the end of the post which is remote from the shank.

6. The tool of claim 5, wherein said incisal stop has a radius of between one-half millimeter and one millimeter less than its adjacent circular working member.

7. The tool of claim 1, wherein the peripheries of said circular members define a cylindrical configuration.

8. The tool of claim 1, wherein the peripheries of said circular working members define a frusto-conical or tapered cylindrical configuration.

9. The tool of claim 1, wherein the peripheries of said circular working members define a spheroidal configuration.

10. The tool of claim 1, wherein the peripheries of said circular working members define a cylindrical configuration and an end-most circular working member has a hemispheroidal tip configuration.

11. The tool of claim 1, wherein said abrasive entirely covers the peripheral surfaces of said circular working members.

12. The tool of claim 1, wherein there are at least three of said circular working members.

13. A method of removing tooth material comprising the steps of:

- a. selecting a dental handpiece fitted with a tool having a plurality of spaced apart circular working members, spaced along a post and with the members having undercut surfaces between their peripheral surfaces and the post that are more greatly undercut nearer the post, and each having abrasive on its surfaces;
- b. utilizing the tool to grind a plurality of at least three grooves of a preselected depth in said tooth material, thereby creating at least two intermediate ridges in said tooth material; and
- c. utilizing said tool to chip away with controlled chipping the intermediate ridges in the tooth material remaining between said grooves by exerting transverse forces on the sides of said grooves, and moving the tool axially in a back-and-forth motion, thereby effecting the removal of the intermediate tooth material.

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