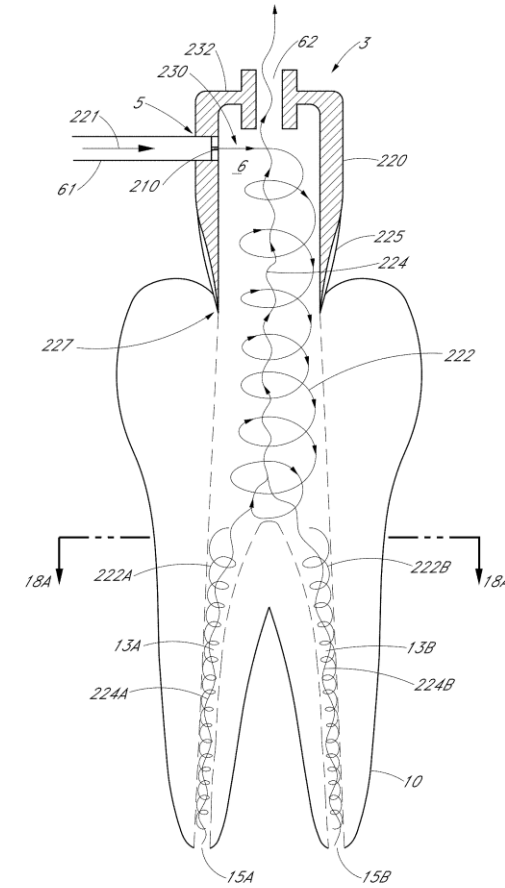


Portfolio View

3rd Quarter 2019



OPTICAL SYSTEMS AND METHODS FOR EXAMINING A TOOTH

US20190117078A1

Product Name:

| | |
|------------------|--------------|
| Priority Date | Sep 12, 2017 |
| Application Date | Sep 12, 2018 |
| Publication Date | Apr 25, 2019 |
| Expiration Date | - |

| US Family Members | Expiration Date |
|-------------------|-----------------|
| US20190117078A1 | |

| Foreign Family Members | Expiration Date |
|------------------------|-----------------|
| WO2019055569A1 | |

| | |
|----------|---|
| IPC | A61B000500 A61B000107 A61B000124 A61B000501 |
| Assignee | SONENDO INC |
| Inventor | Sharma, Manu Khakpour, Mehrzad Bergheim, Bjarne |

Independent Claims:

1 . A dental system to optically examine a dental structure, the system comprising: a mechanical assembly sized and shaped to be inserted into a mouth of a patient; an optical assembly configured to provide an illumination beam to a portion of the dental structure and to collect light from the portion of the dental structure, the optical assembly mounted on the mechanical assembly; and an electronic processing system configured to: analyze the information recovered from the collected light; and determine a characteristic representative of the portion of the dental structure based on the analysis.

9 . - 15 . (canceled)

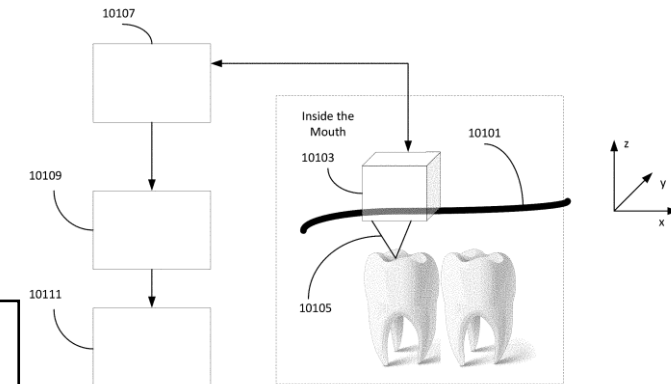
17 . A dental system to optically examine a dental structure, the system comprising: a mechanical assembly sized and shaped to be inserted into a mouth of a patient; an optical assembly configured to provide an illumination beam to a portion of the dental structure and to collect light from the portion of the dental structure, the optical assembly mounted on the mechanical assembly, the mechanical assembly configured to move the optical assembly relative to the dental structure to obtain a plurality of optical signals representative of a condition of the dental structure.

21 . - 24 . (canceled)

28 . A dental system to optically examine a dental structure, the system comprising: an optical assembly configured to provide an illumination beam to a portion of the dental structure and to collect light from the portion of the dental structure; and an electronic processing system configured to: analyze the information recovered from the collected light; determine a characteristic representative of the portion of the dental structure based on the analysis; and render the determined characteristic on a display device as a heat map, the heat map displaying different values of the determined characteristic with different indicia on the display device.

29 . (canceled)

33 . - 84 . (canceled)



APPARATUS AND METHODS FOR CLEANING TEETH AND GINGIVAL POCKETS

US10098717B2

Product Name:

| | |
|------------------|--------------|
| Priority Date | Apr 13, 2012 |
| Application Date | Oct 09, 2014 |
| Publication Date | Oct 16, 2018 |
| Expiration Date | Apr 11, 2033 |

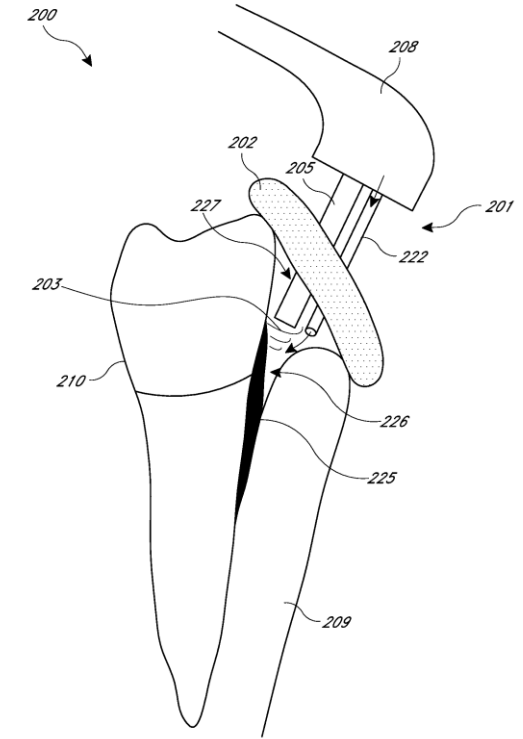
| US Family Members | Expiration Date |
|-------------------|-----------------|
| US10098717B2 | Apr 11, 2033 |
| US20140099597A1 | |
| US20150140503A1 | Apr 11, 2033 |
| US20190183618A1 | |

| Foreign Family Members | Expiration Date |
|------------------------|-----------------|
| AU2013245689A1 | Aug 25, 2016 |
| CA2870321A1 | |
| CN104487016A | Apr 12, 2033 |
| CN104487016B | Apr 12, 2033 |
| CN107260346A | |
| EP2836157A1 | Apr 12, 2033 |
| EP2836157A4 | Apr 12, 2033 |
| EP2836157B1 | Apr 12, 2033 |
| JP2015512761A | |
| JP2019188187A | |
| WO2013155492A1 | |

| | |
|----------|---|
| IPC | A61C000100 A61C000107 A61C001702 A61C001720 |
| Assignee | SONENDO INC |
| Inventor | Bergheim, Bjarne Khakpour, Mehrzad |

Independent Claims:

1. A system for removing dental deposits from an exterior surface of one or more teeth or gum tissue in a mouth of a mammal, the system comprising: a mouthpiece sized and shaped to be inserted into the mouth; and an active energy outlet comprising a fluid motion source in fluid communication with the mouthpiece, the fluid motion source comprising one or more fluid ports, the fluid motion source configured to deliver liquid to the mouth and to remove liquid from the mouth through the one or more fluid ports, wherein the active energy outlet is operable to create oscillatory movement of liquid to and from the mouth through the one or more fluid ports at variable frequencies, including oscillatory movement of liquid to and from the mouth within a first frequency range during a first treatment phase and within a second frequency range during a second treatment phase, the second frequency range differing from the first frequency range.
31. A system for removing dental deposits from an exterior surface of one or more teeth or gum tissue in a mouth of a mammal, the system comprising: a mouthpiece sized and shaped to be inserted into the mouth; an active energy outlet comprising a fluid motion source in fluid communication with the mouthpiece, the fluid motion source comprising one or more fluid ports, the fluid motion source configured to deliver liquid to the mouth and to remove liquid from the mouth through the one or more fluid ports; and a control mechanism configured to control the operation of the active energy outlet, wherein the active energy outlet is operable to create oscillatory movement of liquid to and from the mouth through the one or more fluid ports at variable frequencies, wherein the control mechanism is configured to shut off the fluid motion source if a monitored pressure reaches a level unsafe for the mammal.
32. A method for removing dental deposits from an exterior surface of one or more teeth or gum tissue in a mouth of a mammal, the method comprising: inserting a mouthpiece into the mouth, the mouthpiece including one or more fluid ports; activating a fluid motion source that is in fluid communication with the mouthpiece to deliver liquid to the mouth and to remove liquid from the mouth through the one or more ports; creating oscillatory movement of liquid to and from the mouth through the one or more ports at variable frequencies during at least first and second treatment phases, wherein creating oscillatory movement comprises: creating oscillatory movement of liquid to and from the mouth at a first frequency range during the first treatment phase; and creating oscillatory movement of liquid to and from the mouth at a second frequency range during the second treatment phase, the second frequency range differing from the first frequency range.



SYSTEMS AND METHODS FOR OBTURATION OF ROOT CANALS

US20180214247A1

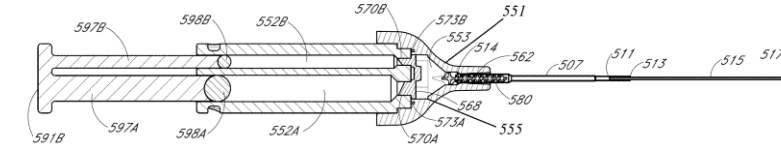
Product Name:

| | |
|------------------|--------------|
| Priority Date | Oct 18, 2016 |
| Application Date | Oct 18, 2017 |
| Publication Date | Aug 02, 2018 |
| Expiration Date | - |

| US Family Members | Expiration Date |
|-------------------|-----------------|
| US20180214247A1 | |
| US20180340371A1 | Oct 09, 2019 |

| Foreign Family Members | Expiration Date |
|------------------------|-----------------|
| WO2018075652A1 | |

| | |
|----------|--|
| IPC | A61C000550 A61C000540 |
| Assignee | SONENDO INC |
| Inventor | Sharma, Manu Minassian, David Khakpour, Mehrzad Bergheim, Bjarne Hyman, Daniel Alexander |



Independent Claims:

1. An apparatus for treating a tooth, the apparatus comprising: a delivery vessel sized to be inserted into a treatment region of a tooth to deliver a filling material to the treatment region; and a manifold coupled to a proximal portion of the delivery vessel, the manifold comprising a manifold chamber to receive the filling material therein, wherein the manifold is configured to couple to a device having an activation mechanism configured to apply sufficient pressure so as to cause thinning of the filling material to allow the filling material to flow into the delivery vessel.
3. (canceled)
7. - 9. (canceled)
11. - 12. (canceled)
14. - 16. (canceled)
18. - 23. (canceled)
27. - 39. (canceled)
43. - 138. (canceled)
139. An apparatus for treating a tooth, the apparatus comprising: a delivery vessel sized to be inserted into a treatment region of a tooth and configured to supply a filling material thereto, the delivery vessel comprising: a capillary; and a reduction conduit having a distal end coupled to a proximal portion of the capillary, the reduction conduit being defined by a stepped reduction in diameter between a first segment having a first diameter and a second segment having a second diameter smaller than the first diameter, wherein the first segment is positioned proximal to the second segment.
140. - 151. (canceled)
163. - 227. (canceled)
228. An apparatus for treating a tooth, the apparatus comprising: a delivery vessel sized to be inserted into a treatment region of a tooth, the delivery vessel configured to supply a filling material to the treatment region; a housing chamber configured to hold and supply at least one component of a filling material to the delivery vessel; and an activation mechanism configured to apply sufficient pressure to the filling material so as to cause thinning of the filling material to allow the filling material to flow into the delivery vessel.
233. - 305. (canceled)

APPARATUS AND METHODS FOR FILLING TEETH AND ROOT CANALS

US9877801B2

Product Name:

| | |
|------------------|--------------|
| Priority Date | Jun 26, 2013 |
| Application Date | Jun 25, 2014 |
| Publication Date | Jan 30, 2018 |
| Expiration Date | Jun 25, 2034 |

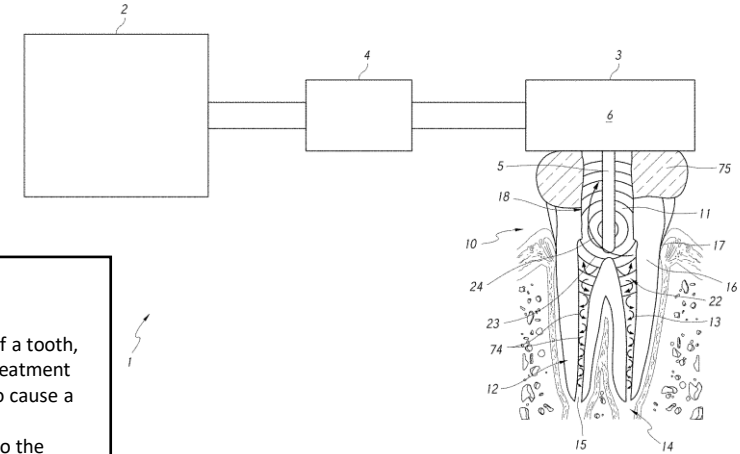
| US Family Members | Expiration Date |
|-------------------|-----------------|
| US9877801B2 | Jun 25, 2034 |
| US20150147718A1 | Jun 25, 2034 |
| US20180360563A1 | |

| Foreign Family Members | Expiration Date |
|------------------------|-----------------|
| CA2911415A1 | |
| EP3013277A2 | |
| WO2014210220A2 | |
| WO2014210220A3 | |

| | |
|----------|---|
| IPC | A61C000108 A61C000540 A61C000550 A61C000562 A61C001702 A61C001720 A61C0017028 |
| Assignee | SONENDO INC |
| Inventor | Khakpour, Mehrzad Bergheim, Bjarne |

Independent Claims:

1. A dental apparatus comprising: a handpiece having a distal portion to be positioned at a treatment region of a tooth, the handpiece further comprising a first fluid supply line and a second fluid supply line to deliver fluid to the treatment region; and a pressure wave generator configured to generate pressure waves through the treatment region to cause a filling material to substantially fill the treatment region, wherein the apparatus is configured to deliver a first composition through the first fluid supply line and a second composition through the second fluid supply line to the treatment region, and wherein the apparatus is further configured to combine the first composition with the second composition at a location in the handpiece or at the treatment region of the tooth to form the filling material to substantially fill the treatment region.



SYSTEMS AND METHODS FOR REMOVING FOREIGN OBJECTS FROM ROOT CANALS

US20170281312A1

Product Name:

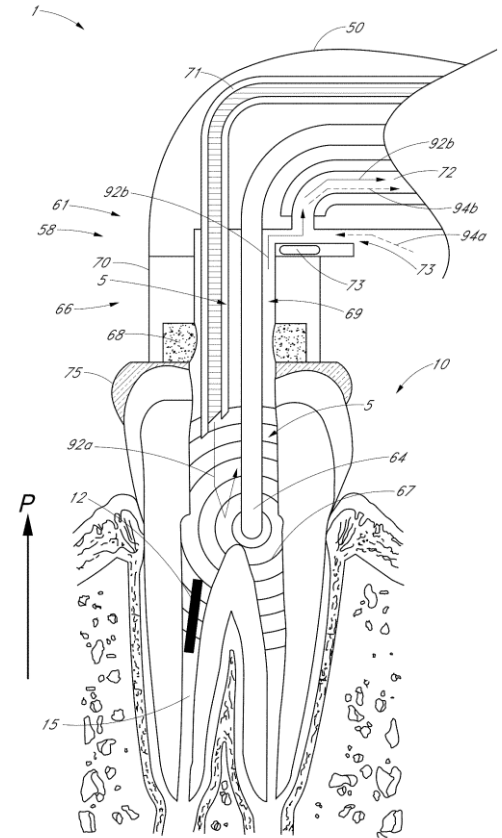
| | |
|------------------|--------------|
| Priority Date | Apr 04, 2016 |
| Application Date | Apr 03, 2017 |
| Publication Date | Oct 05, 2017 |
| Expiration Date | - |

| US Family Members | Expiration Date |
|-------------------|-----------------|
| US20170281312A1 | |

| | |
|----------|--------------------------------------|
| IPC | A61C000546 A61C001702 A61C001720 |
| Assignee | SONENDO INC |
| Inventor | Khakpour, Mehrzad Bergheim, Bjarne |

Independent Claims:

1. A method for removing a foreign object from a root canal of a tooth, the method comprising: positioning a fluid motion generator to be in fluid communication with the root canal of the tooth; supplying fluid to the root canal; generating fluid motion in the root canal with the fluid motion generator; and moving the foreign object with the fluid motion in a proximal direction towards the fluid motion generator.
2. (canceled) 4. (canceled)
5. The method claim 1, wherein the fluid motion generator comprises a pressure wave generator, the method further comprising generating pressure waves in the root canal, the generated pressure waves and fluid motion causing the foreign object to move in the proximal direction.
10. (canceled) 12. (canceled) 13. (canceled) 14. (canceled) 15. (canceled) 16. (canceled) 20. (canceled) 21. (canceled) 22. (canceled) 23. (canceled) 24. (canceled)
28. A method for removing a foreign object from a root canal of a tooth, the method comprising: positioning a pressure wave generator to be in fluid communication with the root canal of the tooth; supplying fluid to the root canal; generating pressure waves and fluid motion in the root canal with the pressure wave generator; and dislodging the foreign object from the root canal with the generated pressure waves.
29. (canceled) 30. (canceled) 31. (canceled) 34. (canceled) 35. (canceled) 36. (canceled) 38. (canceled) 41. (canceled) 42. (canceled) 43. (canceled)
44. A system for removing a foreign object from a root canal of a tooth, the system comprising: a fluid motion generator configured to generate fluid motion in the root canal with the fluid motion generator and to move the foreign object from the root canal with the fluid motion in a proximal direction towards the fluid motion generator; and a controller operably coupled with the fluid motion generator, the controller configured to: receive a user selection signal indicative of a selected treatment procedure, the selected treatment procedure comprising a procedure to move the foreign object; determine system parameters associated with the selected treatment procedure; and transmit instructions to system components to operate the fluid motion generator to cause the foreign object to move in the proximal direction.
45. (canceled) 48. (canceled) 49. (canceled)



DENTAL TREATMENT SYSTEM

US9504536B2

Product Name:

| | |
|------------------|--------------|
| Priority Date | Feb 04, 2013 |
| Application Date | Feb 04, 2014 |
| Publication Date | Nov 29, 2016 |
| Expiration Date | Feb 04, 2034 |

| US Family Members | Expiration Date |
|-------------------|-----------------|
| US20150010882A1 | Feb 04, 2034 |
| US20170281305A1 | |
| US9504536B2 | Feb 04, 2034 |

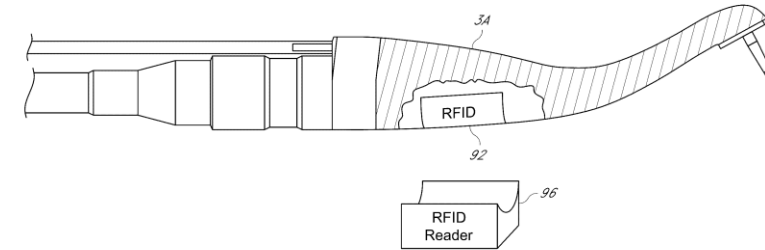
| Foreign Family Members | Expiration Date |
|------------------------|-----------------|
| CA2900252A1 | |
| EP2951019A1 | Feb 04, 2034 |
| EP2951019B1 | Feb 04, 2034 |
| WO2014121293A1 | |

| | |
|----------|--|
| IPC | A61C001702 A61C000100 A61C000108 A61C000502 A61C0017028 |
| Assignee | SONENDO INC |
| Inventor | Bergheim, Bjarne Khakpour, Mehrzad Chen, Jennifer Dechelette, Alexis |

Independent Claims:

1. A dental treatment system comprising: a console including at least one fluid reservoir and at least one electrical component; a treatment instrument sized to be disposed in a mouth of a patient at a treatment location for one or more teeth, the treatment instrument including: a pressure wave generator producing pressure waves across a broad spectrum of frequencies; at least one inlet through which fluid from the fluid reservoir enters the treatment instrument; at least one outlet through which said fluid is directed at the treatment location; and a communications chip storing data about one or more operational characteristics of the treatment instrument or a treatment procedure, wherein the communications chip stores a unique identifier associated with the particular treatment instrument; and a reader communicating with the console and being capable of obtaining data from the communications chip, wherein, in response to receiving a communication from the console indicating use of the treatment instrument in the treatment procedure, the reader is configured to send a signal to the treatment instrument, and processing electronics of the treatment instrument are configured to write data to a memory accessible by the communications chip that, in response to receiving the signal, prevents the treatment instrument from being used in another treatment procedure.

33. A dental treatment apparatus for treating a tooth, the apparatus comprising: a treatment instrument sized to be disposed in a mouth of a patient at a treatment location for one or more teeth, the treatment instrument including: a pressure wave generator to produce pressure waves across a broad spectrum of frequencies; at least one inlet through which fluid enters the treatment instrument; at least one outlet through which said fluid is directed at the treatment location; and a communications chip storing data about one or more operational characteristics of the treatment instrument or a treatment procedure, wherein the communications chip stores a unique identifier associated with the particular treatment instrument, wherein the communications chip is configured to communicate the data to a reader, wherein, in response to receiving a signal indicating use of the treatment instrument in the treatment procedure, processing electronics of the treatment instrument are configured to write data to a memory accessible by the communications chip that prevents the treatment instrument from being used in another treatment procedure.



LIQUID JET APPARATUS AND METHODS FOR DENTAL TREATMENTS

US9492244B2

Product Name:

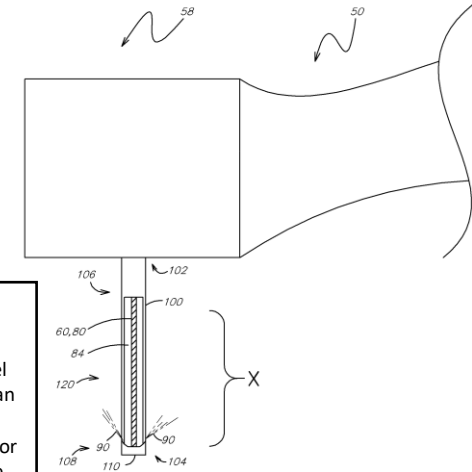
| | |
|------------------|--------------|
| Priority Date | Nov 13, 2009 |
| Application Date | Nov 12, 2010 |
| Publication Date | Nov 15, 2016 |
| Expiration Date | Mar 24, 2031 |

| | |
|----------|---|
| IPC | A61C001702 A61C000502 A61C0017028 |
| Assignee | BERGHEIM BJARNE GHARIB MORTEZA KHAKPOUR MEHRZAD PHAM MICHELE TEBBS RICHARDS SONENDO INC |
| Inventor | Bergheim, Bjarne Gharib, Morteza Khakpour, Mehrzad Pham, Michele Tebbs, Richard S. |

| US Family Members | Expiration Date | Foreign Family Members | Expiration Date |
|-------------------|-----------------|------------------------|-----------------|
| US10420630B2 | Nov 12, 2030 | CN107115154A | |
| US20110117517A1 | Mar 24, 2031 | EP2498713A1 | Nov 12, 2030 |
| US20120237893A1 | Oct 21, 2031 | EP2498713A4 | Nov 12, 2030 |
| US20130040267A1 | Feb 20, 2014 | EP2498713B1 | Nov 12, 2030 |
| US20170273758A1 | Nov 12, 2030 | EP2629693A2 | |
| US20180116761A1 | | EP2629693A4 | |
| US9492244B2 | Mar 24, 2031 | EP3384870A1 | |
| US9675426B2 | Oct 21, 2031 | IL219648A | May 08, 2032 |
| | | IL219648D0 | May 08, 2032 |
| | | IL225829A | Apr 18, 2033 |
| | | IL225829D0 | Apr 18, 2033 |
| | | IL261307D0 | |
| AU2010319321A1 | Nov 12, 2030 | JP05902096B2 | Nov 12, 2030 |
| AU2010319321B2 | Nov 12, 2030 | JP06241997B2 | Oct 21, 2031 |
| AU2011316839A1 | Oct 21, 2031 | JP2013510688A | Nov 12, 2030 |
| AU2011316839B2 | Oct 21, 2031 | JP2013544120A | Oct 21, 2031 |
| AU2012202315A1 | Mar 12, 2015 | JP2018038846A | |
| BR112013009708A2 | Dec 12, 2017 | KR2012099717A | Dec 13, 2015 |
| CA2780800A1 | | WO2011060327A1 | |
| CA2815219A1 | | WO2012054905A2 | |
| CN102724929A | Nov 12, 2030 | WO2012054905A3 | |
| CN102724929B | Nov 12, 2030 | | |
| CN103347462A | Oct 21, 2031 | | |
| CN103347462B | Oct 21, 2031 | | |

Independent Claims:

1. A dental instrument comprising: a nozzle configured to produce a high-velocity liquid jet; a positioning member having a channel through which the high-velocity liquid jet travels, the positioning member having a proximal end portion and a distal end portion; an impingement member disposed at the distal end portion of the positioning member and having an impingement surface; and a plurality of openings through the distal end portion of the positioning member, wherein the impingement member comprises one or more angled or curved portions that angle or curve back towards the proximal end portion of the positioning member, wherein the one or more angled or curved portions extend distally beyond distal ends of the openings, wherein the nozzle is arranged such that the high-velocity liquid jet impacts the impingement surface at a point distally beyond the distal ends of the openings, and wherein the openings are configured to allow outflow of liquid from the liquid jet after impact with the impingement surface.
35. A dental instrument comprising: a positioning member having a channel configured to deliver a high-velocity liquid jet to a tooth, the positioning member having a proximal end portion and a distal end portion; and an impingement member disposed at the distal end portion of the positioning member and having an impingement surface, the instrument configured such that the high-velocity liquid jet impacts the impingement surface during operation of the high-velocity liquid jet, wherein the impingement member comprises one or more flexible members.
37. A dental instrument comprising: a positioning member having a channel configured to deliver a high-velocity liquid jet to a tooth, the positioning member having a proximal end portion and a distal end portion; and an impingement member disposed at the distal end portion of the positioning member and having an impingement surface, the instrument configured such that the high-velocity liquid jet impacts the impingement surface during operation of the high-velocity liquid jet, wherein at least a portion of the impingement member comprises a material that is at least partially permeable to the liquid jet.
39. A dental instrument comprising: a nozzle configured to produce a high-velocity liquid jet; a guide tube having a proximal portion and a distal portion, the guide tube comprising a channel configured to guide the liquid jet along a jet axis toward the distal portion of the guide tube; and an impingement member disposed near the distal portion of the guide tube and having an impingement surface, the instrument configured such that the liquid jet impacts the impingement surface during operation of the liquid jet at a portion of the impingement surface that is substantially perpendicular to the jet axis, wherein the impingement member comprises one or more angled or curved portions that angle or curve back towards the proximal portion of the guide tube, the one or more angled or curved portions being disposed substantially symmetrically relative to the jet axis.
60. A dental instrument comprising: a nozzle configured to produce a high-velocity liquid jet; a guide tube having a proximal portion and a distal portion, the guide tube comprising a channel configured to guide the liquid jet toward the distal portion of the guide tube, the channel extending along a longitudinal axis; and an impingement member disposed near the distal portion of the guide tube and having an impingement surface, the instrument configured such that the liquid jet impacts the impingement surface during operation of the liquid jet, wherein the impingement surface comprises a concave surface facing the liquid jet, the concave surface substantially symmetric about the longitudinal axis of the channel.



DENTAL HANDPIECE

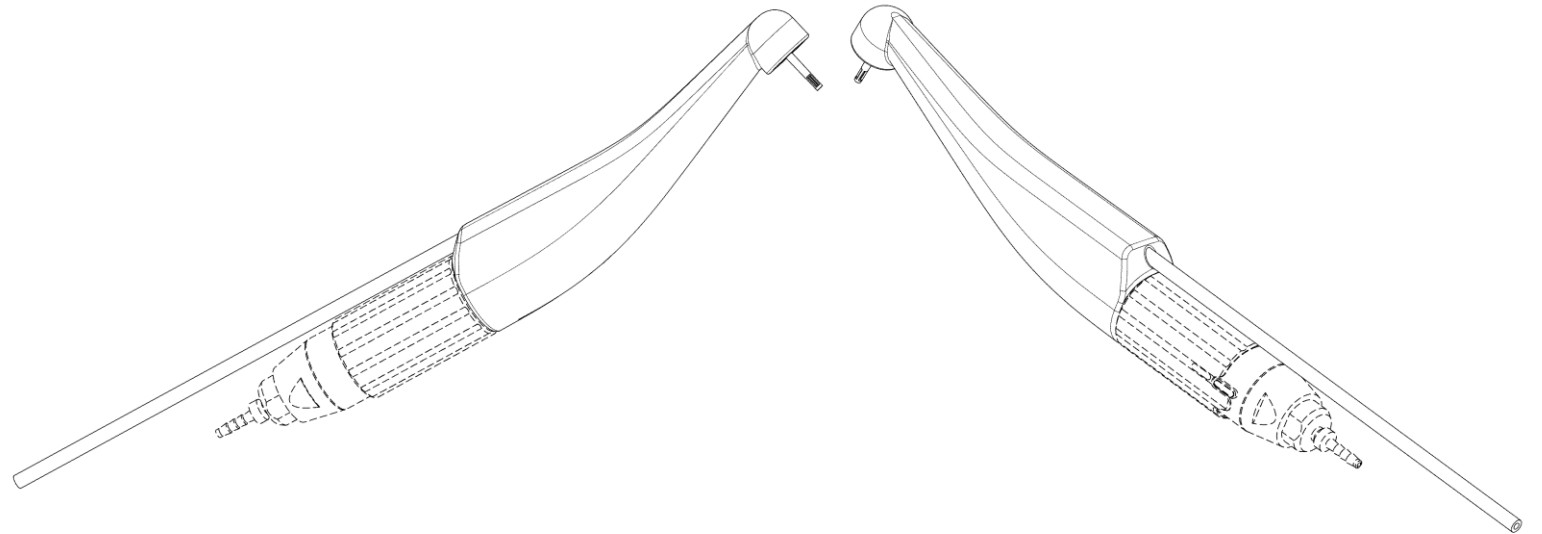
USD745966S1

Product Name:

| | |
|------------------|--------------|
| Priority Date | Apr 15, 2013 |
| Application Date | Apr 15, 2013 |
| Publication Date | Dec 22, 2015 |
| Expiration Date | Dec 22, 2029 |

| US Family Members | Expiration Date |
|-------------------|-----------------|
| USD745966S1 | |

| | |
|----------|--|
| IPC | - |
| Assignee | SONENDO INC |
| Inventor | Piorek, Steven Bergheim, Bjarne Edwards, Craig Khakpour, Mehrzad Pham, Michele |



APPARATUS AND METHODS FOR TREATING TEETH

US20150173852A1

Product Name:

| | |
|------------------|--------------|
| Priority Date | May 01, 2013 |
| Application Date | May 01, 2014 |
| Publication Date | Jun 25, 2015 |
| Expiration Date | Sep 04, 2019 |

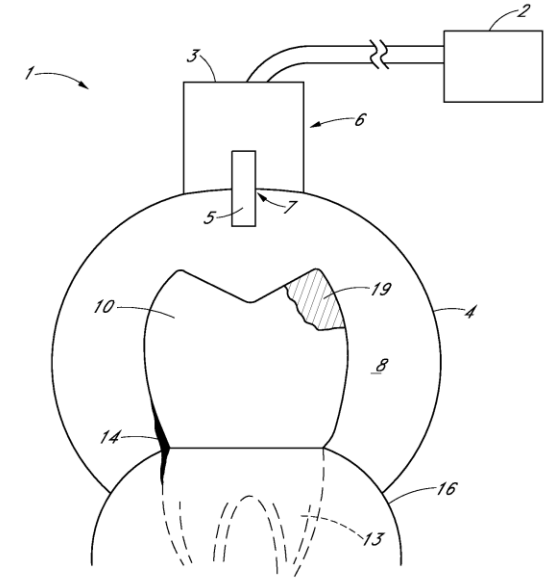
| US Family Members | Expiration Date |
|-------------------|-----------------|
| US20150173852A1 | Sep 04, 2019 |

| Foreign Family Members | Expiration Date |
|------------------------|-----------------|
| CA2910809A1 | |
| EP2991576A2 | |
| WO2014179619A2 | |
| WO2014179619A3 | |

| | |
|----------|---|
| IPC | A61C000108 A61C000100 A61C000302 A61C000502 A61C001702 A61C001720 |
| Assignee | SONENDO INC |
| Inventor | Khakpour, Mehrzad Bergheim, Bjarne Evans, Ryan |

Independent Claims:

- 1 . An apparatus for treating a tooth or gum tissue, the apparatus comprising: a tooth cap for supporting a treatment device during a treatment procedure, the tooth cap comprising: a platform to support the treatment device, the platform comprising an access port to provide a portion of the treatment device with access to a treatment region of the tooth or gum tissue; and a wall coupled with and angled relative to the platform, the wall configured to be attached to the tooth or gum tissue during treatment.
- 27 . A system for treating a tooth or gum tissue, the system comprising: a treatment device; a tooth cap for supporting the treatment device during a treatment procedure, the tooth cap including a platform to support the treatment device, the platform comprising an access port to provide a portion of the treatment device with access to a treatment region of the tooth or gum tissue, and a wall coupled with and angled relative to the platform; and coupling material to be placed between the wall and the tooth or gum tissue to attach the tooth cap to the tooth, gum tissue, or both during treatment.
- 40 . A method of treating a tooth or gum tissue, the method comprising: positioning a tooth cap on a tooth with a wall of the tooth cap extending along a side surface of the tooth attaching at least the wall of the tooth cap to a portion of the side surface of the tooth or to gum tissue, the tooth cap comprising a platform and an access port through the platform; positioning a treatment device on the platform; and activating the treatment device to treat a treatment region of the tooth or gum tissue through the access port.
- 57 . A method for cleaning a tooth or gum tissue, the method comprising: disposing a treatment device near a treatment region of the tooth or gum tissue such that a portion of the treatment device is in fluid communication with a root canal of the tooth and an outer side surface of the tooth; and activating the treatment device to substantially clean diseased regions of the root canal and at least one of undesirable dental deposits and a carious region from the outer side surface of the tooth.
- 64 . - 88 . (canceled)



CONSOLE FOR DENTAL APPARATUS

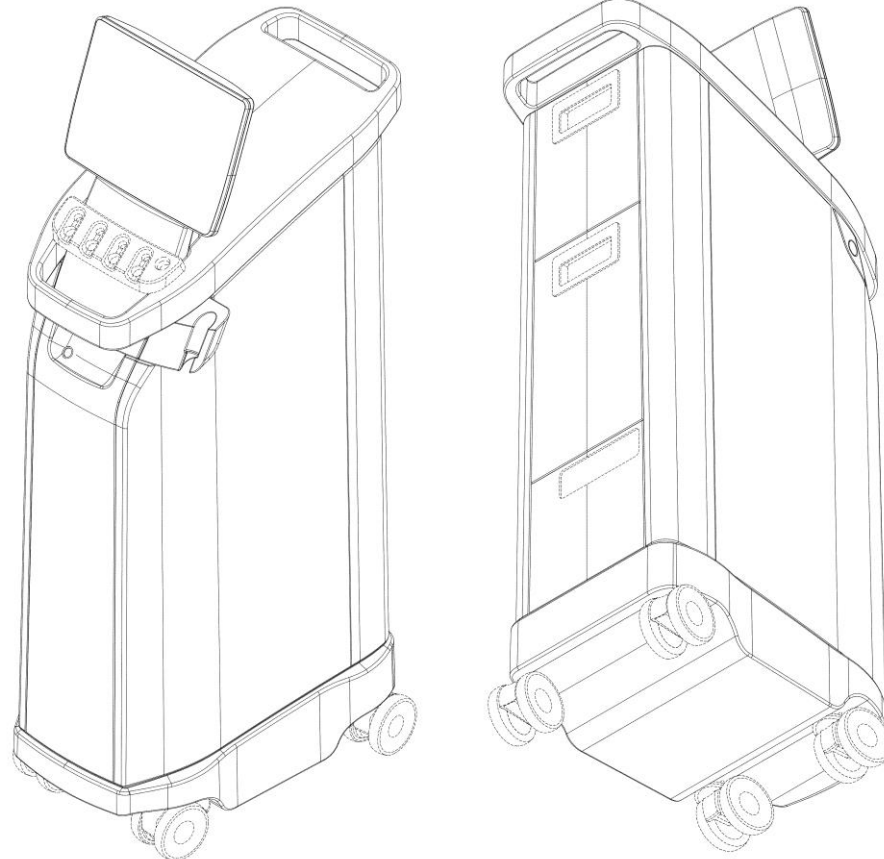
USD726324S1

Product Name:

| | |
|------------------|--------------|
| Priority Date | Apr 15, 2013 |
| Application Date | Apr 15, 2013 |
| Publication Date | Apr 07, 2015 |
| Expiration Date | Apr 07, 2029 |

| US Family Members | Expiration Date |
|-------------------|-----------------|
| USD726324S1 | |

| | |
|----------|--|
| IPC | - |
| Assignee | SONENDO INC |
| Inventor | Duncan, Matthew Piorek, Steven Bergheim, Bjarne Cook, Richard Puzichowski, George |



APPARATUS AND METHODS FOR CLEANING TEETH

US20150044632A1

Product Name:

| | |
|------------------|--------------|
| Priority Date | Mar 22, 2012 |
| Application Date | Sep 19, 2014 |
| Publication Date | Feb 12, 2015 |
| Expiration Date | Jun 25, 2019 |

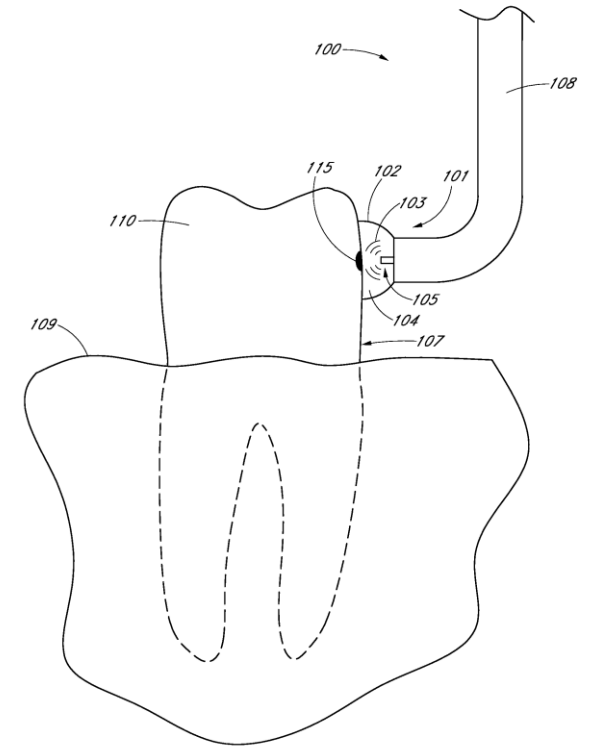
| US Family Members | Expiration Date |
|-------------------|-----------------|
| US20150044632A1 | Jun 25, 2019 |

| Foreign Family Members | Expiration Date |
|------------------------|-----------------|
| AU2013235347A1 | Mar 15, 2033 |
| AU2013235347B2 | Mar 15, 2033 |
| CA2867703A1 | |
| CN104470464A | |
| EP2836156A1 | |
| EP2836156A4 | |
| IN201408727P1 | |
| JP06407140B2 | Mar 15, 2033 |
| JP2015510829A | Mar 15, 2033 |
| JP2019022684A | |
| WO2013142385A1 | |
| WO2013142385A8 | |

| | |
|----------|--------------------------------------|
| IPC | A61C001702 A61C001720 |
| Assignee | SONENDO INC |
| Inventor | Bergheim, Bjarne Khakpour, Mehrzad |

Independent Claims:

1. A system for treating a tooth having a carious region, the system comprising: a fluid platform having a chamber sized and shaped to retain fluid, the chamber configured to be coupled to and at least partially seal against an external surface of the tooth over the carious region; and a pressure wave generator having a distal end configured to be positioned in the chamber and configured to generate pressure waves in the retained fluid sufficient to clean the carious region.
17. A method for treating a tooth having a carious region, the method comprising: applying a cap over the carious region of the tooth, the cap comprising a chamber; sealing at least a portion of the cap to an exterior surface the tooth; at least partially filling the chamber with fluid; positioning a pressure wave generator in the chamber such that at least a portion of the pressure wave generator is immersed in fluid in the chamber; and activating the pressure wave generator in the chamber to clean the carious region of the tooth.
24. A method for cleaning a carious region on a tooth, the carious region disposed in a space at least partially between two adjacent teeth, the method comprising: retaining fluid in the space; and propagating pressure waves through the retained fluid in the space to substantially clean the carious region.
29. A system for cleaning a carious region of a tooth, the carious region disposed in a space at least partially between two adjacent teeth, the system comprising: a fluid retainer configured to at least partially retain fluid in the space; and a pressure wave generator configured to propagate pressure waves through the retained fluid in the space between the teeth to clean the carious region.
36. A method for cleaning a carious region of a tooth, the method comprising: directing a high-speed liquid jet against the tooth at or near the carious region on an exterior surface of the tooth; and maintaining the liquid jet in contact with the tooth at or near the carious region until substantially all of the carious region is removed.



APPARATUS AND METHODS FOR TREATING ROOT CANALS OF TEETH

US8753121B2

Product Name:

| | |
|------------------|--------------|
| Priority Date | Apr 20, 2006 |
| Application Date | Apr 19, 2007 |
| Publication Date | Jun 17, 2014 |
| Expiration Date | Dec 31, 2028 |

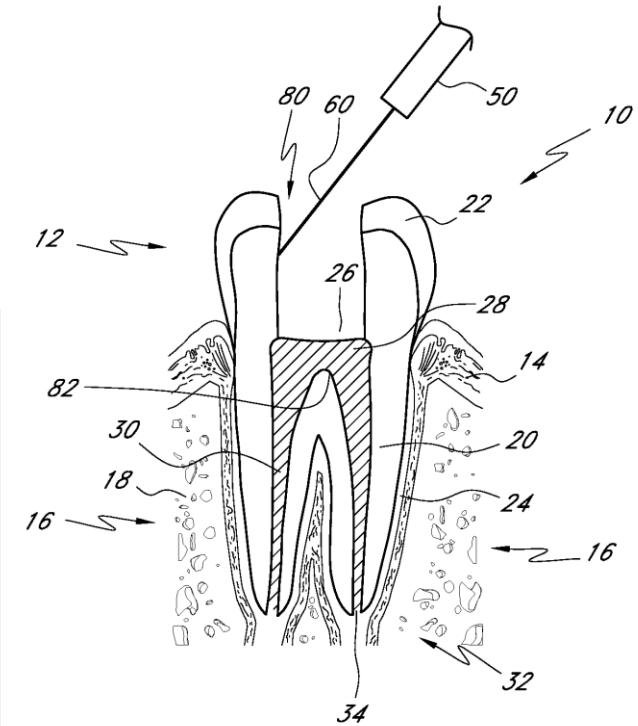
| | |
|----------|---|
| IPC | A61C000302 A61C000502 |
| Assignee | GHARIB MORTEZA ADAMS JOSHUA HARS ERIK BERGHEIM BJARNE STOCKS KARL DOHERTY LANCE SONENDO INC |
| Inventor | Gharib, Morteza Adams, Joshua Hars, Erik Bergheim, Bjarne Stocks, Karl Doherty, Lance |

| US Family Members | Expiration Date |
|-------------------|-----------------|
| US10010388B2 | Aug 03, 2028 |
| US10016263B2 | Apr 19, 2027 |
| US10039625B2 | Apr 19, 2027 |
| US20070248932A1 | Dec 31, 2028 |
| US20150132712A1 | Aug 03, 2028 |
| US20150366634A1 | |
| US20160324600A1 | Apr 19, 2027 |
| US20160367346A1 | Apr 19, 2027 |
| US20190262109A1 | |
| US20190282347A1 | |
| US8753121B2 | Dec 31, 2028 |

| Foreign Family Members | Expiration Date |
|------------------------|-----------------|
| AU2007240780A1 | Apr 19, 2027 |
| AU2007240780B2 | Apr 19, 2027 |
| CA2649905A1 | Apr 19, 2027 |
| CA2649905C | Apr 19, 2027 |
| EP2015698A2 | Apr 19, 2027 |
| EP2015698A4 | Apr 19, 2027 |
| EP2015698B1 | Apr 19, 2027 |
| EP3311770A1 | |
| WO2007124038A2 | |
| WO2007124038A3 | |

Independent Claims:

1. A method of removing organic material that fills a root canal of a tooth, comprising: introducing liquid that is substantially free from dissolved gases into the tooth; propagating an acoustic wave through the liquid in the tooth that provides vibration in at least a portion of the tooth or the root canal; and detaching organic material filling the canal from the surrounding dentinal tissue using the vibration provided by the acoustic wave, wherein propagating the acoustic wave comprises activating a liquid jet, and wherein introducing the liquid comprises activating the liquid jet.
22. A method of removing organic material from dentinal tubules which extend laterally from a root canal of a tooth, comprising: introducing a substantially gas-free liquid into the tooth; and introducing acoustic energy into a plurality of tubules through dentinal tissue such that at least a portion of an odontoblastic process within the tubules is detached from surrounding dentinal tissue and released from the tubule, wherein introducing acoustic energy comprises activating a liquid jet, and wherein introducing the substantially gas-free liquid comprises activating the liquid jet.
33. A method for removing organic material from a root canal of a tooth comprises: introducing a substantially gas-free liquid into the tooth; propagating acoustic energy in a portion of the tooth or the root canal; and using said introduced liquid and said acoustic energy to cause cavitations in fluid within the root canal such that organic material within the canal is detached from surrounding dentinal tissue, wherein propagating acoustic energy comprises activating a liquid jet, and wherein introducing the substantially gas-free liquid comprises activating the liquid jet.



APPARATUS AND METHODS FOR ROOT CANAL TREATMENTS

US20120276497A1

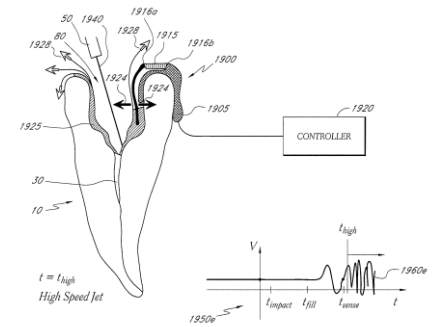
Product Name:

| | |
|------------------|--------------|
| Priority Date | Jan 25, 2007 |
| Application Date | Dec 06, 2011 |
| Publication Date | Nov 01, 2012 |
| Expiration Date | Apr 15, 2016 |

| US Family Members | Expiration Date |
|-------------------|-----------------|
| US20100143861A1 | Jan 02, 2012 |
| US20110111365A1 | Jan 02, 2012 |
| US20120276497A1 | Apr 15, 2016 |

| Foreign Family Members | Expiration Date |
|------------------------|-----------------|
| EP2111164A2 | Oct 01, 2014 |
| EP2111164A4 | Oct 01, 2014 |
| EP2276414A1 | Aug 17, 2016 |
| EP2276414A4 | Aug 17, 2016 |
| EP2821027A2 | Oct 02, 2015 |
| EP2821027A3 | Oct 02, 2015 |
| WO2008092125A2 | |
| WO2008092125A3 | |
| WO2009137815A1 | |

| | |
|----------|--|
| IPC | A61C001904 A61C000502 A61C000504 |
| Assignee | GHARIB MORTEZA ADAMS JOSHUA BERGHEIM BJARNE PIOTROWSKI ADAM E PHAM MICHELE GOUSHCHA OLEG SONENDO INC |
| Inventor | Gharib, Morteza Adams, Joshua Bergheim, Bjarne Piotrowski, Adam E. Pham, Michele Goushcha, Oleg |



Independent Claims:

1.-165. (canceled)

166. A motion detector for detecting motion of material near an apex of a tooth in situ during treatment of the tooth with a liquid jet device, the motion detector comprising: an acoustic detector configured to provide a signal in response to detection of acoustic energy from the tooth; and a processor configured to receive the signal and, based at least in part on the signal, to detect motion of material near the apex of the tooth, wherein the processor is further configured to generate a shut off signal for the liquid jet device if the motion is detected.

171. A method for detecting motion at an apex of a tooth during cleaning of the tooth using a liquid jet, the method comprising: detecting motion of material near the apex of the tooth; and automatically generating a shutoff signal for the liquid jet in response to the detected motion.

177. An apparatus for removing organic material from a tooth, the apparatus comprising: an energy generator configured to couple energy to the tooth, the energy causing cavitation within the tooth, the cavitation generating an acoustic signal; and an acoustic receiver configured to detect a cavitation-induced acoustic signal propagating from the tooth to the receiver during coupling of the energy to the tooth.

179. An apparatus for removing organic material from a tooth, the apparatus comprising: an acoustic energy generator configured to couple first acoustic energy to a dentinal surface of a tooth; and an acoustic receiver configured to detect second acoustic energy that propagates from the tooth during coupling of the first acoustic energy to the tooth.

184. An apparatus for removing organic material from a tooth, the apparatus comprising: a first acoustic energy generator configured to couple first acoustic energy to a first dentinal surface of a tooth; a second acoustic energy generator configured to couple second acoustic energy into the tooth for propagation therein; and an acoustic receiver configured to detect at least a portion of the second acoustic energy that propagates from the tooth.

189. A method comprising: detaching organic material within a root canal of a tooth from surrounding dentin; and detecting a detachment event by detecting an acoustic signal propagating from the tooth.

194. A method comprising: cleaning a root canal of a tooth by applying sufficient energy to detach organic material within the root canal from surrounding dentin; monitoring an energy responsive characteristic associated with the cleaning during application of the energy so as to detect a detachment event defined by a change in the energy responsive characteristic; and automatically producing a control signal in response to the detection of the detachment event to terminate application of the detachment energy.

199. An apparatus for removing organic material from a root canal, the apparatus comprising: a liquid jet assembly configured to produce a high velocity beam of liquid capable of cleaning the root canal of organic material; a sensor configured to detect completion of the cleaning and, in response, to produce a signal; and a controller configured to automatically terminate the high velocity beam upon receipt of the signal from the sensor.

200. A method for acoustically coupling an acoustic element to a tooth, the method comprising: positioning an end of an acoustic element near a surface of a tooth; disposing a flowable material between the end of the acoustic element and the surface of the tooth; and hardening the flowable material.

206. A dental instrument comprising: a first nozzle configured to output a first liquid beam; and a second nozzle configured to output a second liquid beam that intersects the first liquid beam at a distance from the first nozzle.

210. A dental instrument comprising: a nozzle configured to output a liquid beam; and an aiming element having an end portion configured to contact a region of a tooth, wherein when the end portion contacts the region of the tooth, the nozzle is a predetermined distance from the region.

215. An aiming element for use with a handpiece having a nozzle capable of outputting a liquid jet, the aiming element comprising: an elongated member having a distal end capable of contacting a location on a tooth and a proximal end capable of attachment to the handpiece, wherein when attached to the handpiece the elongated member does not impede propagation of the liquid jet, and wherein when the distal end contacts the location on the tooth, the nozzle is a predetermined distance from the location.

216. A method for monitoring a tooth in a patient's mouth, the method comprising: directing a low-velocity liquid jet toward a location in a tooth; detecting whether liquid from the liquid jet is present at the location of the tooth; generating a signal in response to the detection; and actuating a high-velocity liquid jet in response to the generated signal.

219. A strain gage for monitoring a tooth, the strain gage comprising: a member configured to be at least partially inserted into an opening in the tooth; and a strain-sensing element coupled to the member, the strain-sensing element configured to generate a signal in response to deformation of the strain-sensing element caused by movement of the member.

225. A dental instrument comprising: a nozzle configured to output a liquid beam along a beam axis; and an aiming element having a distal end portion configured to contact a region of a tooth, the aiming element having a channel substantially aligned with the beam axis; wherein when the distal end portion contacts the region of the tooth, the nozzle is a predetermined distance from the region.

233. An aiming element for use with a handpiece having a nozzle capable of outputting a liquid jet along an axis, the aiming element comprising: an elongated member having a distal end capable of contacting a location on a tooth and a proximal end capable of attachment to the handpiece, the elongated member having a channel configured to permit propagation of the liquid jet along the axis; wherein when attached to the handpiece the channel is substantially aligned with the axis of the liquid jet, wherein when the distal end contacts the location on the tooth, the nozzle is a predetermined distance from the location on the tooth.

242. A method for treating a root canal of a tooth, the method comprising: directing a high-velocity liquid jet toward a first region of a root canal for a treatment time period; and applying, after the treatment time period, a disinfectant to the root canal for a disinfectant time period.

