United States District Court,
D. Massachusetts.

BICON, INC. and Diro, Inc,
Plaintiffs.
v.
The STRAUMANN COMPANY and Institut Straumann AG,
Defendants.

No. CIV.A. 01-10269-GAO

July 18, 2003.

Owner of patent for dental implant device sued competitor for infringement. Construing claims, the District Court, O'Toole, J., held that: (1) preamble was limitation on claim; (2) basal portion of abutment had to be convex; and (3) increase in cuff's outer diameter did not have to be continuous.

Claims construed.

5,749,731. Construed.

Kevin C. Cain, Peabody & Arnold, Boston, MA, Berj A. Terzian, Pennie & Edmonds, New York City, for Bicon, Inc.

Jason C. Kravitz, Cornelius J. Moynihan, Jr., Nixon Peabody, LLP, Boston, MA, for Institut Straumann AG.

MEMORANDUM AND ORDER

O'TOOLE**, District Judge.**

In this action, Diro, Inc. and Bicon, Inc. (collectively "Bicon") allege that the defendants, The Straumann Company and Institut Straumann AG (collectively "Straumann"), are manufacturing and selling products which infringe Claim 5 of Bicon's patent entitled "Apparatus For Preserving Interdental Papilla And Method For Using,"U.S. Patent No. 5,749,731 (" '731 patent"). Straumann counters by asserting that the '731 patent is invalid, and that even if valid, Straumann's products are not infringing.

The Court's present task is to construe the meaning and scope of Claim 5 of the '731 patent. Both parties have offered the Court proposed constructions of Claim 5, and they have presented evidence in support of their respective contentions at an evidentiary two-day hearing.

A. ***Claim Construction Methodology***

[1] It is well established that patent infringement cases proceed in two steps. "First, the claims of the patent must be construed to determine their scope. Second, a determination must be made as to whether the properly construed claims read on the accused device." Interactive Gift Express, Inc. v. Compuserve, Inc., 256 F.3d 1323, 1330 (Fed.Cir.2001) (citation omitted). The first step, claim construction, is a question solely for the court. Markman v. Westview Instruments, Inc., 517 U.S. 370, 388-89, 116 S.Ct. 1384, 134 L.Ed.2d 577 (1996).

[2] [3] Although a court may ultimately rely on a variety of evidence to give meaning to the terms of a patent claim, it "should look first to the intrinsic evidence of record, *i.e.*, the patent itself, including the claims, the specification and, if in evidence, the prosecution history. Such intrinsic evidence is the most significant source of the legally operative meaning of disputed claim language." Vitronics Corp. v. Conceptronic, Inc., 90 F.3d 1576, 1582 (Fed.Cir.1996) (citation omitted). Therefore, claim construction always begins with the language of the claim itself, and the "ordinary and accustomed meaning of a disputed claim term is presumed to be the correct one." K-2 Corp. v. Salomon S.A., 191 F.3d 1356, 1362-63 (Fed.Cir.1999). Put another way, a term must be given "the full range of its ordinary meaning as understood by persons skilled in the relevant art." Texas Digital Sys., Inc. v. Telegenix, Inc., 308 F.3d 1193, 1202 (Fed.Cir.2002). *See also* Johnson Worldwide Assocs., Inc. v. Zebco Corp., 175 F.3d 985, 989 (Fed.Cir.1999) ("a court must presume that the terms in the claim mean what they say, and, unless otherwise compelled, give full effect to the ordinary and accustomed meaning of claim terms").

[4] Since a patent's terms may be highly technical and specialized, and a judge usually is not a person skilled in the relevant art, he is not required to ascertain the ordinary meaning of a claim's terms in a vacuum. For example, although dictionaries are, strictly speaking, extrinsic to the patent, they may be used to help understand a term's ordinary meaning to one skilled in the relevant art. *See* CCS Fitness, Inc. v. Brunswick Corp., 288 F.3d 1359, 1366 (Fed.Cir.2002). "It has been long recognized ... that dictionaries, encyclopedias and treatises are particularly useful resources to assist the court in determining the ordinary and customary meanings of claim terms." Texas Digital, 308 F.3d at 1202. "Indeed, these materials may be the most meaningful sources of information to aid judges in better understanding both the technology and the terminology used by those skilled in the art to describe the technology." Id. at 1203. *See also* Vitronics, 90 F.3d at 1584 n. 6 (noting that judges "are free to consult [treatises and dictionaries] at any time in order to better understand the underlying technology").

[5] [6] [7] [8] In some cases, a claim's preamble may also play an important role in the proper construction of its terms. "Generally, the preamble does not limit the claims. However, the preamble may be limiting when the claim drafter chooses to use both the preamble and the body to define the subject matter of the claimed invention. If the preamble is necessary to give life, meaning and vitality to the claim, then the claim preamble should be construed as limiting. This is determined on the facts of each case in view of the claimed invention as a whole." Allen Eng'g Corp. v. Bartell Indus., 299 F.3d 1336, 1346 (Fed.Cir.2002) (citations and internal quotation marks omitted). The preamble may limit a claim when a particular disputed phrase depends on the preamble for antecedent basis, "when the preamble is essential to understand limitations or terms in the claim body," or when the preamble recites "additional structure or steps underscored as important by the specification." Catalina Mktg. Int'l, Inc. v. Coolsavings.com, Inc., 289 F.3d 801, 808 (Fed.Cir.2002). However, "preambles describing the use of an invention generally do not limit the claims because the patentability of apparatus or composition claims depends on the claimed structure, not on the use or purpose of that structure." Id. at 809.

[9] [10] In addition to these aids, other portions of the patent can act as an important source of information.

When a court seeks to understand the meaning of a claim's terms, "it is always necessary to review the specification to determine whether the inventor has used any terms in a manner inconsistent with their ordinary meaning. The specification acts as a dictionary when it expressly defines terms used in the claims or when it defines terms by implication." Vitronics, 90 F.3d at 1582. If the language of a claim is not self-explanatory, the specification "is the single best guide to the meaning of a disputed term." *Id*. *See also* Texas Digital, 308 F.3d at 1203 (recognizing that because "words often have multiple dictionary definitions, some having no relation to the claimed invention, the intrinsic record must always be consulted to identify which of the different possible dictionary meanings of the claim terms in issue is most consistent with the use of the words by the inventor"). However, while a court may turn to the specification to understand and clarify a claim's terms, it cannot use the specification to place unnecessary limits on a term. As the Federal Circuit has explained, "limitations appearing in the specification will not be read into claims, and ... interpreting what is *meant* by a word *in* a claim is not to be confused with adding an extraneous limitation appearing in the specification, which is improper." In re Cruciferous Sprout Litig., 301 F.3d 1343, 1348 (Fed.Cir.2002) (citations and internal quotation marks omitted, emphasis in original).

[11] [12] Finally, if the intrinsic evidence by itself does not permit the court to establish the clear meaning of a term, the court may turn to extrinsic evidence, such as expert and inventor testimony. *See* Zodiac Pool Care v. Hoffinger Indus., 206 F.3d 1408, 1414 (Fed.Cir.2000) ("The court turns to extrinsic evidence only when the intrinsic evidence is insufficient to establish the clear meaning of the asserted claim."). A court also may consult extrinsic evidence "to ensure that the claim construction it is tending to from the patent file is not inconsistent with the clearly expressed, plainly apposite, and widely held understandings in the pertinent technical field." AFG Indus. v. Cardinal IG Co., 239 F.3d 1239, 1249 (Fed.Cir.2001). However, the Court must proceed with caution when looking to such additional evidentiary sources. While extrinsic evidence may be consulted "to assist in understanding the underlying technology," it "may never be used for the purpose of varying or contradicting the terms in the claims." Interactive Gift Express, 256 F.3d at 1332 (citations and internal quotation marks omitted). When the intrinsic evidence adequately establishes the proper meaning of the disputed terms, it is inappropriate to consult extrinsic evidence to establish the ordinary meaning of the disputed terms. *See* Vitronics, 90 F.3d at 1583 (when "an analysis of the intrinsic evidence alone will resolve any ambiguity in a disputed claim term," it is "improper to rely on extrinsic evidence").

B. *Construction of Claim 5 of* the '731 Patent

Applying the framework laid out above to the present case, the first task is a careful examination of the language of the claim itself. Claim 5 of the '731 patent asserts ownership in the following invention:

An emergence cuff member for use in preserving the interdental papilla during the procedure of placing an abutment on a root member implanted in the alveolar bone of a patient in which the abutment has a frusto-spherical basal surface portion and a conical surface portion having a selected height extending therefrom comprising a generally annular member formed of biocompatible synthetic plastic having first and second ends, a bore extending from the first to the second ends, the bore having a taper generally matching that of the conical surface portion of the abutment, the larger end of the bore being at the first end, the outer surface of the annular member forming a feathered edge with the bore at the first end of the annular member, the distance between the first and second ends being less than the height of the conical surface, the diameter of the cuff member increasing in the direction going from the first end to the second end, and a radially inwardly extending flexible lip formed at the first end of the cuff member.

Very broadly speaking, Claim 5 describes a device which is used by practitioners in the field of dentistry to aid in the implantation of a prosthesis upon which an artificial tooth or crown will be secured.

[13] One issue that needs to be resolved at the outset is whether the preamble in Claim 5 should be read as helping to define terms used in the claiming language that follows it. The preamble is that portion of the claim language that precedes the word "comprising." It appears at 6:15-20 of the patent. The preamble reads:

"An emergence cuff member for use in preserving the interdental papilla during the procedure of placing an abutment on a root member implanted in the alveolar bone of a patient in which the abutment has a frusto-spherical basal surface portion and a conical surface portion having a selected height extending therefrom ...."

This language introduces and provides an antecedent basis for key terms appearing later in the claim. The subsequent references to an "abutment" and a "conical surface" of that abutment refer back to the use of those terms in the preamble, and they cannot be understood fully without consulting the preamble. FN1

FN1. It is important to recognize that although the preamble identifies a possible *use* for the emergence cuff member-to preserve the interdental papilla while an abutment is placed on a root member-the claim is not limited only to that use. *See* Catalina Mktg., 289 F.3d at 809. Here, the specification itself discusses several other potentially useful functions of the cuff. These include helping the dentist take an impression a few millimeters below the gum line, helping the dentist place the crown a below the gum line, minimizing gum tissue irritation, and enabling the dentist to bond a temporary crown to the cuff. 2:61-67.

The conclusion that the preamble helps define the terms used in the rest of the claim can be tested. A preamble "generally is not limiting when the claim body describes a structurally complete invention such that deletion of the preamble phrase does not affect the structure or steps of the claimed invention." Catalina Mktg., 289 F.3d at 809. Here is the claim language without the preamble:

a generally annular member formed of biocompatible synthetic plastic having first and second ends, a bore extending from the first to the second ends, the bore having a taper generally matching that of the conical surface portion of the abutment, the larger end of the bore being at the first end, the outer surface of the annular member forming a feathered edge with the bore at the first end of the annular member, the distance between the first and second ends being less than the height of the conical surface, the diameter of the cuff member increasing in the direction going from the first end to the second end, and a radially inwardly extending flexible lip formed at the first end of the cuff member.

The structure of the invention claimed in this language cannot be fully understood without reference to the specific antecedent information set out in the preamble. The "generally annular member" that is claimed is described as having a bore with a taper that matches "that of the conical surface portion of the abutment." What conical surface? What abutment? Without resort to the preamble, these terms are undefined. The preamble easily clears up the uncertainty and lets the reader know what the inventor had conceived. He is referring to the abutment with a conical surface that is placed on a root member implanted in the aveolar bone of a patient, as described in the preamble. It is clear that the inventor used the preamble to introduce some basic terms which would then be employed in describing the invention.

Having resolved that the preamble may be consulted to aid in understanding what the inventor has claimed, it is possible to construe the individual limiting terms of Claim 5:

1. ***Abutment***

[14] Bicon contends that, as used in Claim 5, the term "abutment" refers to any structure that could perform the *function* of an abutment. Straumann argues that "abutment" refers to a particular physical structure as described in the claim and explained in more detail in the specification. Straumann's argument is more persuasive.

As noted above, a crucial physical characteristic of the "cuff" or "annular member" is described (and limited) by reference to the abutment. That is, the annular member has a bore with a taper that matches the taper of the conical surface of the abutment. The abutment referred to in the claim, then, is not any structure that can serve the function of an abutment; rather it is an abutment having the structure described in the preamble. It is an abutment that "has a frusto-spherical basal surface portion and a conical surface portion having a selected height extending therefrom ...." 6:18-20. In this respect, the preamble serves as the dictionary for the term "abutment" as used in the claiming language that follows the preamble. Moreover, the specification confirms this. For example, it says that the feathered edge at the first end of the cuff is "adapted to serve as a smooth continuation of the frusto-spherical surface of the basal portion of the abutment member." 2:51-53. This refers not to any structure that can function as an abutment, but rather to an abutment having "a frusto-spherical basal surface portion," as defined in the preamble.

Further, the abutment is separate from the "root member" that is implanted in the alveolar bone; it is "placed on" the root member. The patent uses the term "member" to denote physically distinct objects which can be used in combination with each other as parts-"members"-of a larger composite device. Thus, the "abutment" and the "root member" are used together. The root member is implanted in the alveolar bone, and the abutment is "placed on" the thus-implanted root member. 6:16-17.

Similarly, in the specification the terms "abutment" and "root member" are consistently used to denote discrete parts which are then assembled into a composite unit. *See, e.g.,* 1:38-42 ("A permanent abutment member having a male or post portion ... is then mounted on the root member with the post portion received in the socket."); 2:25-28 ("It is known to use so called healing abutments which comprise various pieces of metal to provide a selected shape which are placed on the root member while the gum is allowed to heal ...."); 3:36-39 ("Head or abutment member 14 is mounted on the root member by means of a post 16 having a locking taper received in socket or bore 18 of root member 10."). *See also* Figure 1 of the '731 patent (included below). Bicon's attempt to separate the term "abutment" from the physical device which it describes is not faithful to the manner in which the patent uses the term.

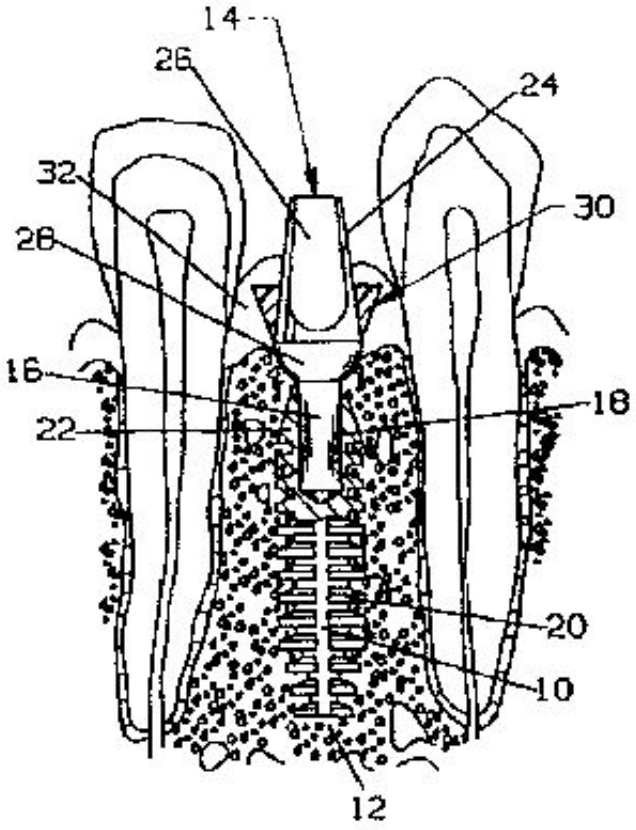

FIG 1

As this discussion indicates, extrinsic evidence is not needed to understand that the term abutment as used in Claim 5 refers to a discrete unit with specific features which then is placed on the separate root member. However, if such evidence were necessary, the testimony of Straumann's experts, Dr. Thomas D. Taylor and Dr. Hans-Peter Weber, on this point was highly credible. Both experts explained that the abutment was a separate piece which is inserted into the root member, which in turn is implanted into the jaw bone of the patient. The testimony by Bicon's expert, Dr. Robert J. Chapman, that the top portion of the root member could also be called the abutment if its shape aided in supporting the crown was not convincing. Dr. Chapman also admitted that his definition of abutment was not the one commonly used by experts in the field of dentistry and dental implants.

2. *Frusto-Spherical Basal Surface Portion*

[15] The "frusto-spherical basal surface portion" is the base of the abutment, the surface of which has a "frusto-spherical" shape. *See* Figure 1 of the '731 patent (this portion of the abutment is labeled 28). "Frusto-spherical" is not a term of dental art, but one from the field of geometry. According to a common dictionary definition, a "frustum" is the "portion of a regular solid left after cutting off the upper part by a plane parallel to the base; or the portion intercepted between two planes, either parallel or inclined to each other." *The Oxford English Dictionary,* vol. VI, at 235 (2d ed.1989). Derived from the noun "frustum,"

"frusto-" is an adjectival qualifier. "Frusto-spherical" rather obviously refers to a solid having the shape of a frustum of a sphere-that is, a sphere the upper portion of which has been "cut off" by a plane. The remaining portion of the sphere would have, just as a full sphere would have, a convex surface.

Bicon argues that the term "frusto-spherical" could also describe an abutment which has a basal portion with a concave surface. Bicon suggests that this alternate shape would be defined by rolling a sphere along the exterior of the base of an abutment. In other words, the frustum would lie in the negative space adjacent to any point of the basal portion's exterior. *See* Pls.' Brief re Claim 5, Diagram entitled "Concave Frusto-Spherical." Bicon has not shown that this alternate definition of "frusto-spherical" is the "ordinary and accustomed meaning" of the term as it would be understood by experts in the field of geometry-a highly dubious proposition to say the least. The only evidence that Bicon has offered to support the viability of this alternate meaning of "frusto-spherical" is testimony by Dr. Vincent J. Morgan, the president of Bicon and the co-inventor of the '731 patent, who is not a mathematician. Even if Bicon's definition is not impossible, there is no evidence offered that it would represent the term's ordinary and accustomed meaning.

Bicon's alternate definition is also incompatible with the rest of the claim language. A key element of the claim is that the emergence cuff has "a radially inwardly extending flexible lip," which is intended to fit snugly around a part of the abutment's frusto-spherical portion. 6:31-32. *See* id., Diagram entitled, "Figure 5 of the '731 Patent-Action of the Lip." This language is perfectly understandable if the "frusto-spherical surface" is convex, but becomes incomprehensible if the surface which the lip is intended to meet is conceived of as concave.

Any remaining doubt about the proper definition of the term "frusto-spherical" is eliminated by the specification. At several points in the specification, the interaction between the abutment and the root member is explained by reference to the center of the sphere which describes the frusto-spherical portion of the abutment. For example, in the preferred embodiments section of the patent, the specification describes how the abutment is placed into the socket of the root member as follows (numerical references refer to Figure 1 of the patent):

Abutment member 14 has an upstanding, generally tapered, conical exterior surface 24 ... and a basal portion 28 having a *convex,* frusto-spherical exterior surface which extends downwardly from the tapered portion. The center of the sphere which defines the frusto-spherical surface lies on the axis of the conical surface so that the fruso-spherical [sic] and conical surfaces intersect along a circle. The frusto-spherical surface is disposed on a seat formed in the alveolar crest with post 16 extending into socket 18 and locked therein.

3:44-54 (emphasis added). In order for this careful description of the abutment to be intelligible, the basal portion itself must be shaped like a portion of a (convex) sphere, so that there is a single center point which can lie on the axis of the conical portion of the abutment. *See also* 1:43-51 (same description used). The specification also reemphasizes the importance of the snug fit and firm hold between the emergence cuff's flexible lip and the basal portion of the abutment. *See* 4:66-5:3 (stating that the lip "slides onto the undercut of the abutment ... to provide a positive seat for the cuff thereby minimizing any tendencies of the soft tissue of the patient to displace the cuff during the suturing procedure"). The discussions of the frusto-spherical portion of the abutment in the specification only make sense if the basal portion of the abutment is convex, thereby making clear that Bicon's alternate definition is not viable.

3. ***Conical Surface Portion Having a Selected Height Extending Therefrom***

The "conical surface portion" of the abutment extends from the basal surface to a selected height. 6:19-20. Since the basal surface is the portion of the abutment closest to the root member, the conical surface extends away from the basal surface, upward in the case of an implant in the lower jaw, and downward in the case of an (inverted) implant in the upper jaw. The abutment's conical surface portion can be made to any suitable height so as to fit properly in the patient's mouth and can be appropriately sized in proportion to the patient's jaw and teeth. This understanding of the term appears to be undisputed by the parties.

4. ***A Generally Annular Member***

[16] The term "a generally annular member" indicates that the emergence cuff is generally circular or ring-like. This understanding of the term is clear from the language of the claim itself. A common dictionary definition of the word "annular" is "of or pertaining to a ring or rings; ring-like, ring-formed, ringed." *The Oxford English Dictionary,* vol. I, at 488 (2d ed.1989).

5. ***Having First and Second Ends***

The emergence cuff resembles a hollow tube, and the reference to it "having first and second ends" simply establishes that there are two ends to the tube. Another way of saying this is that the cuff, when placed as contemplated on the abutment, has a top and a bottom. Although this is clear from the claim's language, it is illustrated by Figures 2 and 5 of the patent.

6. ***A Bore Extending From the First and Second Ends***

Consistent with the annular or ring-like nature of the emergence cuff, there is a "bore" running through its center permitting it to be fitted on the abutment. This bore runs the full length of the cuff, from one end to the other. Again, although this understanding is clear from the patent's language, Figures 1, 2, and 5 of the patent are good illustrations.

7. ***The Bore Having a Taper Generally Matching That of the Conical Surface Portion of the Abutment, the Larger End of the Bore Being at the First End***

Since the emergence cuff fits around the abutment, its bore is shaped to accommodate the contours of the abutment. As discussed above, the upper portion of the abutment is generally conical, so the cuff's bore has the same shape, i.e., the bore is narrower at the second end (the top), and its circumference widens out toward the first end (the bottom). Nothing beyond the language of the claim itself is necessary to reach this understanding.

8. ***The Outer Surface of the Annular Member Forming a Feathered Edge With the Bore at the First End of the Annular Member***

[17] "Feathered edge" is a term of art commonly used in the field of prosthodontics which would be clear to an expert in the field. As "Johnston's Modern Practice in Fixed Prosthodontics" explains, "The point at which a preparation terminates on the tooth is called the *finish line*." Defs.' Ex. 28. One type of finish line is the feathered edge. When a preparation terminates in a feathered edge, this means it tapers down to such a fine point that it is difficult to tell where the preparation ends and the tooth surface begins. *See* id. *See also* Defs.' Hr'g, Ex. 1 (diagram illustrating the feather edge). Although there was some disagreement amongst the experts at the hearing about how fine a finish line has to be in order to qualify as a feathered edge, there was no disagreement that an ideal feathered edge tapers to such a fine line that it is virtually flush with the

underlying surface.

Applying this ordinary and accustomed meaning of the term "feathered edge" to the language of Claim 5, the phrase "the outer surface of the annular member forming a feathered edge with the bore at the first end of the annular member" means that the first end of the cuff tapers down to a very fine point at the bottom end. Ideally, at the bottom end, the cuff's outer surface would be almost flush with the outer surface of the frusto-spherical portion of the abutment. Hence, the specification states that the bottom end of the cuff will "serve as a smooth continuation of the frusto-spherical surface of the basal portion of the abutment member ...." 2:51-53.

9. ***The Distance Between the First and Second Ends Being Less Than the Height of the Conical Surface***

The meaning of this phrase is undisputed and dictates that the length of the emergence cuff is less than the height of the conical portion of the abutment. This meaning is clear from the text of Claim 5 alone. Although no additional evidence is needed to understand this phrase, Figure 1 in the specification shows how the conical portion of the abutment rises above the gum line, while the emergence cuff remains below the gum line, aiding in the preservation of the interdental papilla.

10. ***The Diameter of the Cuff Member Increasing in the Direction Going From the First End to the Second End***

[18] The outside diameter of the surface of the emergence cuff is smaller at the first end than at the second end. This is the inverse of the change in the diameter of the bore, which is larger at the first end and grows smaller toward the second end. Although this is clear from the language of the Claim, Figure 1 helps illustrate the change in the cuff's diameter. By widening the outside surface from first end to second, the cuff maintains the natural, triangular shape of the interdental papilla while the patient awaits the addition of a crown onto the abutment. As the specification explains, the widening shape of the cuff creates "a sulcus having a predetermined, optimized shape." 2:60-61. After the cuff is removed, the dentist can "take an impression and cement the crown a couple of millimeters below the gum line for a cosmetically pleasing result." 2:61-63.

Straumann argues that the phrase "increasing in the direction going from the first end to the second end" should be construed to mean that the diameter of the cuff continuously increases over a substantial portion of its entire height. However, Straumann's chief support for this narrower definition is the preamble's statement regarding the preferred use of the cuff. While Straumann is correct that the primary purpose of an invention is "a relevant consideration," CVI/Beta Ventures, Inc. v. Tura LP, 112 F.3d 1146, 1160 (Fed.Cir.1997), a statement regarding the invention's use cannot unnecessarily limit the meaning of terms. Since the patent is not necessarily limited to the use of an emergence cuff to preserve the interdental papilla, *see* Catalina Marketing, 289 F.3d at 809, this preferred use of the cuff cannot force additional, limiting meaning onto the phrase "increasing ... from the first end to the second end." The plain language of the claim merely requires that the device's diameter increases, to some degree, between the first and the second end.

11. ***A Radially Inwardly Extending Flexible Lip Formed at the First End of the Cuff Member***

A key aspect of the invention set forth in Claim 5 is the flexible lip located at the first end of the emergence cuff (closest to the gingiva and the root member on which the abutment is placed). Up until this point, Claim 5 largely tracks the language of Claim 1. The flexible lip is one of the features which sets Claim 5

apart from Claim 1. As Claim 5 itself explains, the flexible lip is a pliable or elastic portion at the bottom of the cuff which curves inward towards the center of the bore. The specification explains that the lip "slides onto the undercut of the abutment, i.e., beyond the greatest circumferential portion, to provide a positive seat for the cuff thereby minimizing any tendencies of the soft tissue of the patient to displace the cuff during the suturing procedure." 4:66-5:3. Again, although the additional information from the specification is unnecessary to establish the ordinary meaning of the claim language describing the lip, it supports and confirms the meaning derived from the claim itself.

C. *Conclusion*

The terms in Claim 5 are construed to have the definitions and meanings set forth above. In particular, the term "abutment" is found to be a reference to a separate device which is then attached to the root member, and the term "frusto-spherical basal surface portion" indicates that the emergence cuff has a convex (not a concave) outer surface.

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