TISSUE-CUTTING MEMBER FOR A BIOPSY DEVICE

FIELD OF THE INVENTION

[0001] The present invention relates generally to tissue cutting members for tissue removing devices such as biopsy devices and the like.

BACKGROUND OF THE INVENTION

[0002] In diagnosing and treating certain medical conditions, such as potentially cancerous tumors, it is usually desirable to perform a biopsy, in which a specimen of the suspicious tissue is removed for pathological examination and analysis. In many instances, the suspicious tissue is located in a subcutaneous site, such as inside a human breast. To minimize surgical intrusion into the patient's body, it is desirable to be able to insert a small instrument into the patient's body to access the targeted site and to separate the biopsy specimen therefrom.

[0003] Tissue cutting members currently used with biopsy devices have a variety of problems. Often tissue becomes trapped between the cutting member and the shaft within which the cutting member is disposed. Also many cutting members currently available in the art are not suitable for effectively separating tough or hard tissue from the target site in a patient's body.

[0004] There is need in the art for cutting members with improved efficiency for separating tissue specimens from a target location in a patient's body.

SUMMARY OF THE INVENTION

[0005] This invention is directed to tissue cutting members for devices for separating tissue from a target site within a patient's body. More particularly, the invention is directed to tissue cutting members and biopsy devices using such tissue cutting members for the separation of a tissue specimen from supporting tissue at

the targeted site within a patient. A suitable biopsy device having a cannula which may be utilized with a tissue cutting member having features of the invention is described in co-pending application Serial No. 11/014,413, filed on December 16, 2004.

[0006] A tissue cutting member embodying features of the invention includes a distal tubular portion having a distal tip with an outer tissue cutting edge, an inner tissue receiving aperture, and a longitudinal axis. Preferably the distal tip of the distal tubular portion has a beveled front face with a leading edge and a trailing edge.

[0007] The tubular distal tubular portion has a longitudinally oriented opening in a wall of the distal tubular portion with an open distal end which opens to the inner tissue receiving aperture, and a closed proximal end. The distal tubular portion of the tissue cutting member has at least a second opening in a wall of the tubular portion and preferably a plurality of openings circumferentially spaced from the open ended slot about the longitudinal axis and preferably the centers of these openings are circumferentially located at about 90°, 135°, or 180° from a midpoint of the longitudinally oriented opening. The one or more circumferentially spaced openings may be one of a variety of shapes, for example, a rectangular shape, a circular shape, or an elongated shape such as an oval or elongated slot. One or more of the openings in the distal tubular portion may be of one shape and one or more of the other openings may be of another shape. The openings allow for the vacuum to be maintained within the biopsy device when the cutting member is cutting and provide stress relief, facilitating radial expansion and/or contraction.

[0008] The distal tubular portion preferably has a flared distal section with a proximal end and a distal end, and a cylindrically shaped proximal section with a

proximal end and a distal end. The open distal end of the longitudinally oriented opening facilitates the flaring of the flared distal section. The flared distal section ensures that the outer tissue cutting edge of the distal tubular portion engages an inner tissue cutting edge of a tissue receiving aperture in the cannula of the biopsy device to cleanly sever the tissue specimen from the supporting tissue and to provide a better tissue specimen for pathological examination.

[0009] These and other advantages of the invention will become more apparent from the following detailed description of the invention and the accompanying exemplary drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

[0010] Figure 1 is a perspective view of the proximal portion of an elongated probe member of a biopsy device that has features of the invention.

[0011] Figure 2 is an enlarged perspective view of a distal portion of the elongated probe shown in Figure 1 illustrating a tissue cutting member embodying features of the invention disposed within the probe.

[0012] Figure 3A is a perspective view of a distal tubular portion of a tissue cutting member embodying features of the invention including two openings with a rectangular shape.

[0013] Figure 3B is a perspective view of the distal tubular portion shown in Figure 3A that has been rotated 180° from the view of Figure 3A.

[0014] Figure 3C is an elevational view of the embodiment of the device shown in Figure 3A.

[0015] Figure 3D is a longitudinal cross sectional view of the distal tubular portion taken along lines 3D-3D in Figure 3C.

[0016] Figure 3E is a transverse cross sectional view of the distal tubular portion taken along lines 3E-3E in Figure 3C.

[0017] Figure 3F is a transverse cross sectional view of the distal tubular portion taken along lines 3F-3F.

[0018] Figure 4A is a perspective view of a distal tubular portion of a tissue cutting member embodying features of the invention including two circular openings.

[0019] Figure 4B is a perspective view of the distal tubular portion shown in Figure 4A that has been rotated 180° from the view of Figure 4A.

[0020] Figure 5A is a perspective view of a distal tubular portion of a tissue cutting member embodying features of the invention including two circular openings and one opening which is an elongated longitudinally oriented slot.

[0021] Figure 5B is a perspective view of the distal tubular portion shown in Figure 5A that has been rotated 180° from the view of Figure 5A.

[0022] Figure 6A is a perspective view of a distal tubular portion of a tissue cutting member embodying features of the invention including two circular openings and one opening which is an elongated longitudinally oriented slot.

[0023] Figure 6B is a perspective view of the distal tubular portion shown in Figure 6A that has been rotated 180° from the view of Figure 6A.

[0024] Figure 7A is a perspective view of distal tubular portion of a tissue cutting member embodying features of the invention including two rectangular openings and one opening which is an elongated longitudinally oriented slot.

[0025] Figure 7B is a perspective view of the distal tubular portion shown in Figure 7A that has been rotated 180° from the view of Figure 7A.

[0026] Figure 8A is a perspective view of a distal tubular portion of a tissue cutting member embodying features of the invention including two rectangular openings and one opening which is an elongated longitudinally oriented slot.

[0027] Figure 8B is a perspective view of the distal tubular portion shown in Figure 8A that has been rotated 180° from the view of Figure 8A.

[0028] Figure 9A is a perspective view of a distal tubular portion of a tissue cutting member embodying features of the invention including two openings which are elongated longitudinally oriented slots.

[0029] Figure 9B is a perspective view of the distal tubular portion shown in Figure 9A that has been rotated 180° from the view of Figure 9A.

[0030] Figure 10A is a perspective view of a distal tubular portion of a tissue cutting member embodying features of the invention including two openings which are elongated longitudinally oriented slots with an enlarged circular shape at the proximal end thereof.

[0031] Figure 10B is a perspective view of the distal tubular portion shown in Figure 10A that has been rotated 180° from the view of Figure 10A.

[0032] Figure 11A is a perspective view of a distal tubular portion of a tissue cutting member embodying features of the invention including two openings which are elongated longitudinally oriented slots each having an enlarged circular shape between the proximal and distal ends thereof.

[0033] Figure 11B is a perspective view of the distal tubular portion shown in Figure 11A that has been rotated 180° from the view of Figure 11A.

[0034] Figure 12A is a perspective view of a distal tubular portion of a tissue cutting member embodying features of the invention including two openings which are elongated longitudinally oriented slots.

[0035] Figure 12B is a perspective view of the distal tubular portion shown in Figure 12A that has been rotated 180° from the view of Figure 12A.

[0036] Figure 13A is a perspective view of a distal tubular portion of a tissue cutting member embodying features of the invention including two openings which are elongated longitudinally oriented slots each having an enlarged circular shape at the proximal end thereof.

[0037] Figure 13B is a perspective view of the distal tubular portion shown in Figure 13A that has been rotated 180° from the view of Figure 13A.

[0038] Figure 14A is a perspective view of a distal tubular portion of a tissue cutting member embodying features of the invention including two openings which are elongated longitudinally oriented slots with an enlarged circular shape at the proximal end thereof.

[0039] Figure 14B is a perspective view of the distal tubular portion shown in Figure 14A that has been rotated 180° from the view of Figure 14A.

[0040] Figure 15A is a perspective view of a distal tubular portion of a tissue cutting member embodying features of the invention including four openings which are elongated longitudinally oriented slots.

[0041] Figure 15B is a perspective view of the distal tubular portion shown in Figure 15A that has been rotated 180° from the view of Figure 15A.

[0042] Figure 16A is a perspective view of a distal tubular portion of a tissue cutting member embodying features of the invention including four openings which are elongated longitudinally oriented slots each having an enlarged circular shape at the proximal end thereof.

[0043] Figure 16B is a perspective view of the distal tubular portion shown in Figure 16A that has been rotated 180° from the view of Figure 16A.

[0044] Figure 17A is a perspective view of a distal tubular portion of a tissue cutting member embodying features of the invention including four openings which are elongated longitudinally oriented slots.

[0045] Figure 17B is a perspective view of the distal tubular portion shown in Figure 17A that has been rotated 180° from the view of Figure 17A.

[0046] Figure 18A is a perspective view of a distal tubular portion of a tissue cutting member embodying features of the invention including four openings which are elongated longitudinally oriented slots each having an enlarged essentially circular shape at the proximal end thereof.

[0047] Figure 18B is a perspective view of the distal tubular portion shown in Figure 18A that has been rotated 180° from the view of Figure 18A.

DETAILED DESCRIPTION OF THE INVENTION

[0048] Figure 1 shows an embodiment of a probe component 10 including a housing 12 and an outer tubular member or cannula 14. The tissue cutting member 16 embodying features of the invention is slidably disposed within an inner lumen 18 in the cannula 14. The probe component 10 may be part of a biopsy device such as that described in co-pending application Serial No. 11/014,413 filed on December 16, 2004. Details of the probe component 10 and other parts of the biopsy device may be found in the aforesaid application.

[0049] The cannula 14 of the probe component 10 has a distal tip 20 and an open tissue receiving aperture 22 spaced proximal to the distal tip 20. The tissue receiving aperture 22 has an inner tissue cutting edge 24. The tissue cutting member 16 is slidably disposed within the inner lumen 18 of the cannula 14 of the probe component, as shown in Figure 2.

[0050] The distal tip 20 of the cannula 14 may have a variety of tip shapes. The shape of the tissue penetrating distal tip disclosed in the above referenced co-pending application Serial No. 11/014,413 has been found to be suitable for penetrating tissue, particularly breast tissue. Alternatively, the distal tip 20 may have an arcuate RF electrode such as disclosed in U.S. Patent No. 6,261,241 and U.S. Patent No. 6,471,700, (all of which have been assigned to the present assignee) that facilitate advancement of the probe through tissue.

[0051] Figures 3A-18B show tissue cutting member 16 having features of the invention including a distal tubular portion 26. Preferably the tubular distal portion has a diameter of between about 0.1 inches and 0.2 inches. The distal tubular portion 26 has a distal tip 28 with an outer tissue cutting edge 30 and an inner tissue receiving aperture 32 and a longitudinal axis 34. The distal tubular portion 26 also includes a longitudinally oriented opening 36 that has an open distal end 38 which opens to the inner tissue receiving aperture 32 and which has a closed proximal end 40. Preferably the longitudinally oriented opening 36 has a length of about 0.1 inches to about 0.3 inches Additionally, a wall 42 of the tubular distal portion 26 has at least a second opening 44 (shown having a rectangular shape in Figures 3A-3F) which is circumferentially spaced from the longitudinally oriented opening 40 about the longitudinal axis 34.

[0052] Preferably the distal tip 28 of the distal tubular portion 26 has a beveled front face 46 with a leading edge 48 and a trailing edge 50. The longitudinally oriented opening 36 in distal tubular portion 26 opens to the trailing edge 50 of the beveled front face 46.

[0053] The distal tubular portion 26 preferably includes a flared distal section 52 which has a proximal end 54 and a distal end 56 and a cylindrically shaped proximal

section 58 which has a proximal end 60 and a distal end 62. The distal tubular portion 26 may have a junction 64 where the proximal end 54 of the flared distal section 52 meets the distal end 62 of the cylindrically shaped proximal section 58. Preferably the flared distal section flares outward about 1° to 3° degrees from the cylindrically shaped proximal section. The open distal end 38 of the longitudinally oriented opening 36 facilitates the flaring of the flared distal section 52 as shown by line 66. The flared distal section 52 ensures that the outer tissue cutting edge 30 of the distal tubular portion 26 engages the inner tissue cutting edge 24 of the tissue receiving aperture 22, as shown in Figure 2, to provide scissor-like cutting motion for separating a tissue specimen from supporting tissue at the target biopsy site.

[0054] The longitudinally oriented opening 36 preferably has an enlarged essentially circular shape 68 at the closed proximal end 40 of the longitudinally oriented opening 36. The closed proximal end 40 of the longitudinally oriented opening 36 can be located entirely within the flared distal section 52 (not shown), entirely within in the cylindrically shaped proximal section 58 as shown in Figures 9A-14B and 17A-18B, or at least partially in the distal end 62 of the cylindrically shaped proximal section 58 as shown in Figures 3A-8B and 15A-16B.

[0055] The second opening 44 (shown with a rectangular shape in Figures 3A-3F) in the wall 42 of the tubular distal portion 26 allows for a vacuum to be maintained within the probe component 10. Preferably the distal tubular portion 26 has a plurality of openings. The openings of the distal tubular portion are circumferentially disposed at an angle about the longitudinal axis 34 and the centers of these openings are preferably circumferentially located at about 90°, 135°, or 180° from a midpoint of the longitudinally oriented opening 36. Preferably a third opening 70 (shown with a rectangular shape in Figures 3A-3F) is provided in the wall 42 of the

distal tubular portion 26 circumferentially spaced from the longitudinally oriented opening 36 and essentially opposite of the second opening 44. The second opening 44 may have a variety of shapes for example, a rectangular shape, a circular shape, or an elongated shape such as an oval or elongated slot. Preferably when the second opening 44 is an elongated slot, the opening has a length of between about 0.1 inches and 0.4 inches. The second opening 44 and the third opening 70 preferably have the same shape, however, one or more of the openings may be of one shape and one or more of the other openings may be of another shape.

[0056] In one embodiment of the device having features of the invention, shown in Figures 3A-3E, the second and third openings 44 and 70 of the distal tubular portion 26 are circumferential rectangular openings. In this embodiment the longitudinal midlines of the second opening 44 and the third opening 70 lie in a plane perpendicular to the longitudinal axis 34 and are located in the flared distal section 52 of the distal tubular portion 26. The closed proximal end 40 of the longitudinally oriented opening 36 is at the proximal end 54 of the flared distal section 52.

[0057] Figures 4A and 4B show a cutting member 16 which embodies features of the invention wherein the second opening 44a and third opening 70a of the distal tubular portion 26 are circular openings and are located in the flared distal section 52. The closed proximal end 40 of the longitudinally oriented opening 36 is located at least partially in the distal end 62 of the cylindrically shaped proximal section 58.

[0058] Figures 5A and 5B show a distal tubular portion 26 of the tissue cutting member 16 wherein the second opening 44b and third opening 70b are circular openings located at least partially in the distal end 62 of the cylindrically shaped proximal portion 58. The closed proximal end 40 of the longitudinally oriented opening 36 is located at the proximal end 54 of the flared distal section 52.

[0059] The distal tubular portion 26 in Figures 5A and 5B also includes a fourth opening 72 which is an elongated longitudinally oriented slot with a closed proximal end 74 and a closed distal end 76. The fourth opening 72 is opposite to the longitudinally oriented opening 36. The closed proximal end 74 of the opening 72 is located at the proximal end 54 of the flared distal section 52. The closed distal end 76 of the fourth opening 72 is located in the flared distal section 52.

[0060] Figures 6A and 6B show a tissue cutting member 10 wherein the distal tubular portion 26 has a second opening 44c and a third opening 70c which are located at least partially in the distal end 62 of the cylindrically shaped section 58. Figures 6A and 6B also include a fourth opening 72a which is an elongated longitudinally oriented slot with a closed proximal end 74a and a closed distal end 76a. The closed proximal end 74a of the fourth opening 72a is in the cylindrically shaped proximal section 58 and the closed distal end 76a of the fourth opening 72a is in the flared distal section 52.

[0061] In the embodiment of the device having features of the invention shown in Figures 7A and 7B, the second opening 44d and the third opening 70d of the distal tubular portion 26 have a rectangular shape and are oriented perpendicular to the longitudinal axis 34. The closed proximal end 40 of the longitudinally oriented opening 36 and the second 44d and third 70d openings are located at least partially in the distal end 62 of the cylindrically shaped proximal section 58.

[0062] Figures 7A and 7B also include fourth opening 72b which is an elongated longitudinally oriented slot with a closed proximal end 74b and a closed distal end 76b. The closed proximal end 74b of the fourth opening 72b is located at the proximal end 54 of the flared distal section 52. The closed distal end 76b of the fourth opening 72b is located in the flared distal section 52.

[0063] Figures 8A and 8B show a distal tubular portion 26 of the tissue cutting member 16 which has a second opening 44e and a third opening 70e which have a rectangular shape and are oriented perpendicular to the longitudinal axis 34. The second 44d and third 70d openings are located at least partially in the distal end 62 of the cylindrically shaped proximal section 58. Figures 8A and 8B also include a fourth opening 72c which is an elongated longitudinally oriented slot with a closed proximal end 74c and a closed distal end 76c. The closed proximal end 74c of the fourth opening 72c is located in the cylindrically shaped proximal section 58 and the closed distal end 76c of the fourth opening 72c is located in the flared distal section 52. In this embodiment the closed proximal end 40 of the longitudinally oriented opening 36 is located at least partially in the distal end 62 of the cylindrically shaped proximal section 58.

[0064] In the embodiment of the device having features of the invention shown in Figures 9A and 9B, the second opening 44f of the tubular distal portion 26 is an elongated longitudinally oriented slot with a closed proximal end 78 and a closed distal end 80. The closed proximal end 78 is located in the cylindrically shaped proximal section 58. The closed distal end 80 of the second opening 44f is located in the flared distal section 52. The third opening 70f is has the same shape as the second opening 44f and the same orientation with respect to the flared distal section 52 and the cylindrically shaped proximal section 58. In this embodiment the closed proximal end 40 of the longitudinally oriented opening 36 is located in the cylindrically shaped proximal section 58.

[0065] Figures 10A and 10B show a distal tubular portion 26 of the tissue cutting member wherein the closed proximal end 40 of the longitudinally oriented opening 36 is in the cylindrically shaped proximal section 54 of the distal tubular portion 26.

The distal tubular portion 26 has a second opening 44g which is an elongated longitudinally oriented slot with a closed distal end 80a and a closed proximal end 78a and an enlarged essentially circular shape 82 at the proximal end 78a thereof. The closed proximal end 78a of the second 44g opening is located in the cylindrically shaped proximal section 58 and the closed distal end 80a of second opening is located in the flared distal section 52. The third opening 70g of the distal tubular portion 26 has the same shape as the second opening 44g and has the same orientation.

[0066] Figures 11A and 11B show a distal tubular portion 26 of the tissue cutting member 16 wherein the distal tubular portion 26 has a second opening 44h which is an elongated longitudinally oriented slot with a closed proximal end 78b and a closed distal end 80b. The second opening also had an enlarged essentially circular shape 84 located between the proximal 78b and distal 80b ends. The closed proximal end 78b of the elongated shape is in the cylindrically shaped proximal section 58 and the closed distal end 80b of the elongated shape is in the distal flared section 52. The enlarged essentially circular shape 84 of the second opening 44h is at least partially in the distal end 62 of the cylindrically shaped proximal section 58. The third opening 70h is the same shape as the second opening 44h and has the same orientation as the second opening 44h. In this embodiment the closed proximal end 40 of the longitudinally oriented opening 36 is in the cylindrically shaped proximal section 58 of the distal tubular portion 26.

[0067] Figures 12A and 12B show a distal tubular portion of the tissue cutting member 26 wherein the closed proximal end 40 of the longitudinally oriented opening 36 is in the cylindrically shaped proximal section 58 of the distal tubular portion 26. The second opening 44i is an elongated longitudinally oriented slot with

a closed proximal end 78c and a closed distal end 80c. The closed proximal end 78c of the first opening 44i is located at the proximal end 54 of the flared distal section 52. The closed distal end 80c of the second opening 44i is located in the flared distal section 52. The third opening 70i has the same shape and orientation as the second opening 44i.

[0068] Figures 13A and 13B show a distal tubular portion 26 of the tissue cutting member 16, which has a second opening 44j which is an elongated longitudinally oriented slot with a closed distal 80d end and closed proximal end 78d. The closed proximal end 78d has an enlarged essentially circular shape 86. The closed distal end 80d of the second opening 44j is located in the flared distal section 52 and the closed proximal end 78d is located at least partially in the distal end 62 of the cylindrically shaped proximal section 58. The third opening 70j has the same shape and orientation as the second opening 44j. In this embodiment the closed proximal end 40 of the longitudinally oriented opening 36 is in the cylindrically shaped proximal section 58 of the distal tubular portion 26.

[0069] Figures 14A and 14B show a distal tubular portion 26 of the tissue cutting member 16 which has a second opening 44k which is an elongated longitudinally oriented slot with a closed proximal end 78e and a closed distal end 80e. The closed proximal end 78e of the elongated slot has an enlarged essentially circular shape 88 which extends toward the longitudinally oriented opening 36. In this embodiment the closed proximal end 40 of the longitudinally oriented opening 36 is in the cylindrically shaped proximal section 58 of the distal tubular portion 26.

[0070] Figures 15A and 15B show a distal tubular portion 26 of the tissue cutting member 16 wherein closed proximal end 40 of the longitudinally oriented opening 36 is located at least partially in the distal end 62 of the cylindrically shaped proximal

section 58. In this embodiment the device has a second opening 44l which is an elongated longitudinally oriented slot. The second opening 44l a closed proximal end 78f and a closed distal end 80f. The closed distal end 80f of the second opening 44l is in the flared distal section 52 of the distal tubular portion 26. The closed proximal end 78f of the second opening 44l is in the cylindrically shaped proximal section 58. The third opening 70l has the same shape and orientation as the second opening 44l.

[0071] Additionally, the embodiment shown in Figures 15A and 15B includes a fourth opening 72d and a fifth opening 90. The fourth opening 72d is an elongated longitudinally oriented slot and has a closed proximal end 74d and a closed distal end 76d. The closed proximal end 74c of the fourth opening 72d is located at the proximal end 54 of the flared distal section 52. The closed distal end 76d of the fourth opening 72d is located in the flared distal section 52. The fourth opening 72d and the fifth opening 90 have lengths which are longer than the length of the second opening 44l and the third opening 70l.

[0072] Figures 16A and 16B show a distal tubular portion 26 of the tissue cutting member 16 which has a second opening 44m, a third opening 70m, a fourth opening 72e, and a fifth opening 90a. The second opening 44m is an elongated longitudinally oriented slot with a closed proximal 78g end and a closed distal end 80g. The closed proximal end 78g of the second opening 44m has an enlarged essentially circular shape 92 which is located at least partially in the distal end 62 of the cylindrically shaped proximal section 58. The closed distal end 80g of the second opening 44m is located in the flared distal section 52. The third opening 70m has the same shape and orientation as the second opening 44m. In this embodiment the closed proximal end 40 of the longitudinally oriented opening 36 is

located at least partially in the distal end 62 of the cylindrically shaped proximal section 58.

[0073] The embodiment in Figures 16A and 16B also includes a fourth opening 72e and a fifth opening 90a. The fourth opening 72e is an elongated longitudinally oriented slot with a closed proximal end 74e and a closed distal end 76e. The closed proximal end 74e of the fourth opening 72e has an enlarged essentially circular shape 94 which is located at least partially in the distal end 62 of the cylindrically shaped proximal section 58. The closed distal end 76e of the fourth opening 72e is located in the flared distal section 52. The fourth opening 72e and the fifth opening 90a have a length which is longer than the length of the second opening 44m and the third opening 70m.

[0074] Figures 17A and 17B show a tubular distal portion 26 of the tissue cutting member 16 wherein the closed proximal end 40 of the longitudinally oriented opening 36 is located in the cylindrically shaped proximal section 58. This embodiment includes a second opening 44n and a third opening 70n. The second opening 44n is an elongated longitudinally oriented slot with a closed proximal end 78h and a closed distal end 80h. The closed proximal end 78h of the second opening 44n is located in the cylindrically shaped proximal section 58. The closed distal end 80h of the second opening 44n is located in the flared distal section 52. The third opening 70m has the same shape and orientation as the second opening 44n.

[0075] The embodiment in Figures 17A and 17B also has a fourth opening 72f and fifth opening 90b. The fourth opening 72f is an elongated longitudinally oriented slot with a closed proximal end 74f and a closed distal end 76f. The closed distal end 76f of the fourth opening 72f is located in the flared distal section 52. The closed

proximal end 76f of the fourth opening 72f is located at the junction 64 between the flared distal section 52 and the cylindrically shaped proximal section 58. The fifth opening 90b has the same shape and orientation as the fourth opening 72f.

[0076] The embodiment of the device shown in Figures 18A and 18B has a second opening 44o which is an elongated longitudinally oriented slot with a closed distal end 80i and a closed proximal end 78i. The closed proximal end 78i of the second opening 44o has an enlarged essentially circular shape located in the cylindrically shaped proximal section 58. The closed distal end 80i of the second opening 44o is located in the flared distal section 52. The third opening 70o has the same shape and orientation as the second opening 44o.

[0077] The embodiment in Figures 18A and 18B also include a fourth opening 72g and a fifth opening 90c. The fourth opening 72g is an elongated longitudinally oriented slot with a closed proximal end 74g and a closed distal end 76g. The closed proximal end 74g of the fourth opening 72g is located at the proximal end 54 of the flared distal section 52. The closed distal end 76g of the fourth opening 72g is located in the flared distal section 52. The fifth opening 90c has the same shape and orientation as the fourth opening 72g. In this embodiment the closed proximal end 40 of the longitudinally oriented opening 36 is in the cylindrically shaped proximal section 54 of the distal tubular portion 26.

[0078] The tissue cutting members shown in 17A and 17B and 18A and 18B may have an additional opening 96 shown in phantom in Figure 18A.

[0079] The tubular portion 28 of the tissue cutting member 16 is preferably formed of surgical grade stainless steel. However, other high strength materials such as MP35N, other cobalt-chromium alloys, NiTi alloys, ceramics, glasses, and high strength polymeric materials or combinations thereof may be suitable. Further

details of the tissue cutting member 16 may be found in the above mentioned application Serial No. 11/014,413, filed on December 16, 2004.

[0080] While particular forms of the invention have been illustrated and described herein, it will be apparent that various modifications and improvements can be made to the invention. For example, while the various embodiments of the invention have been described herein in terms of a biopsy device, it should be apparent that the devices and methods of utilizing the device may be employed to remove tissue for purposes other than for biopsy, i.e. for treatment or other diagnoses. Moreover, individual features of embodiments of the invention may be shown in some drawings and not in others, but those skilled in the art will recognize that individual features of one embodiment of the invention can be combined with any or all the features of another embodiment. Accordingly, it is not intended that the invention be limited to the specific embodiments illustrated. It is therefore intended that this invention to be defined by the scope of the appended claims as broadly as the prior art will permit.

[0081] Terms such a "element", "member", "device", "section", "component", "portion", "section", "means", "step" and words of similar import, when used herein shall not be construed as invoking the provisions of 35 U.S.C. §112(6) unless the following claims expressly use the terms "means" or "step" followed by a particular function without specific structure or action. All patents and patent applications referred to above are hereby incorporated by reference in their entirety.

WHAT IS CLAIMED IS:

1. A tissue cutting member for separating a tissue specimen from a target site within a patient's body comprising:

a. a distal tubular portion having a distal tip with an outer tissue cutting edge, an inner tissue receiving aperture and a longitudinal axis;

b. a longitudinally oriented opening in the distal tubular portion that has an open distal end which opens to the inner tissue receiving aperture and a closed proximal end; and

c. at least a second opening in a wall of the distal tubular portion circumferentially spaced from the longitudinally oriented opening about the longitudinal axis.

2. The tissue cutting member of claim 1 wherein the distal tubular portion has a flared distal section and a cylindrically shaped proximal section

3. The tissue cutting member of claim 1 wherein the closed proximal end of the longitudinally oriented opening has and essentially circular shape.

4. The tissue cutting member of claim 2 wherein the second opening in the wall of the distal tubular portion has a circular shape.

5. The tissue cutting member of claim 2 wherein the second opening is located in the flared distal section of the distal tubular portion.

6. The tissue cutting member of claim 2 wherein the second opening is located in the cylindrically shaped proximal section of the distal tubular portion.

7. The tissue cutting member of claim 2 wherein the second opening is located at least partially in the distal end of the cylindrically shaped proximal section.

8. The tissue cutting member of claim 2 wherein the second opening in the wall of the distal tubular portion has a rectangular shape.

9. The tissue cutting member of claim 8 wherein the second opening is oriented longitudinally.

10. The tissue cutting member of claim 8 wherein the second opening is oriented transversely.

11. The tissue cutting member of claim 2 wherein the second opening is an elongated longitudinally oriented slot which has a closed proximal end and a closed distal end.

12. The tissue cutting member of claim 11 wherein the closed distal end of the second opening and the closed proximal end of the second opening are located in the flared distal section.

13. The tissue cutting member of claim 11 wherein the closed distal end of the second opening is located in the flared distal section and the closed proximal end of the second opening is located at least partially in the cylindrically shaped proximal section.

14. The tissue cutting member of claim 11 wherein the closed distal end of the second opening is located in the flared distal section and the closed proximal end of the second opening is located in the cylindrically shaped proximal section of the distal tubular portion.

15. The tissue cutting member of claim 11 wherein the second opening has an enlarged essentially circular shape between the closed proximal end of the second opening and the closed distal end of the second opening.

16. The tissue cutting member of claim 11 wherein the closed proximal end of the second opening has an enlarged essentially circular shape.

17. The tissue cutting member of claim 2 wherein the tubular distal portion has a third opening in the wall of the distal tubular portion circumferentially spaced from the longitudinally oriented opening about the longitudinal axis.

18. The tissue cutting member of claim 17 wherein the third opening in the wall of the distal tubular portion has the same shape as the second opening.

19. The tissue cutting member of claim 17 wherein the third opening has the same orientation along the distal tubular portion as the second opening.

20. The tissue cutting member of claim 17 wherein the third opening in the wall of the distal tubular portion is essentially opposite of the second opening.

21. The tissue cutting member of claim 17 wherein the tubular distal portion has a fourth opening in the wall of the distal tubular portion circumferentially spaced from the longitudinally oriented opening about the longitudinal axis.

22. The tissue cutting member of claim 21 wherein the fourth opening is located in a wall of the distal tubular portion opposite of the longitudinally oriented opening.

23. The tissue cutting member of claim 21 wherein the fourth opening is an elongated longitudinally oriented slot with a closed proximal end and a closed distal end.

24. The tissue cutting member of claim 23 wherein the closed distal end of the fourth opening and the closed proximal end of the fourth opening are located in the flared distal section.

25. The tissue cutting member of claim 23 wherein the closed distal end of the fourth opening is located in the flared distal section and the closed proximal end of the fourth opening is located in the cylindrically shaped proximal section of the distal tubular portion.

26. The tissue cutting member of claim 23 wherein the closed distal end of the fourth opening is located in the flared distal section and the closed proximal end of the fourth opening is located at least partially in the cylindrically shaped proximal section.

27. The tissue cutting member of claim 21 wherein the tubular distal portion has a fifth opening in the wall of the distal tubular portion circumferentially spaced from the longitudinally oriented opening about the longitudinal axis.

28. The tissue cutting member of claim 27 wherein the fifth opening in the wall of the distal tubular portion has the same shape as the fourth opening.

29. The tissue cutting member of claim 27 wherein the fifth opening in the wall of the distal tubular portion has the same orientation along the distal tubular portion as the fourth opening.

30. The tissue cutting member of claim 2 wherein the closed distal end of the longitudinally oriented opening is located at least partially in the distal end of the cylindrically shaped proximal section.

31. The tissue cutting member of claim 2 wherein the closed distal end of the longitudinally oriented opening is located in the cylindrically shaped proximal section.

32. The tissue cutting member of claim 2 wherein in the distal tip of the distal tubular portion has a beveled front face.

33. The tissue cutting member of claim 32 wherein the beveled front face has a leading edge and a trailing edge.

34. The tissue cutting member of claim 33 wherein the longitudinally oriented opening in the distal tubular portion opens to the trailing edge of the beveled front face.

35. The tissue cutting member of claim 1 wherein the distal tubular portion is formed of stainless steel.

36. The tissue cutting member of claim 1 wherein the distal tubular portion is formed of formed of a material selected from the group consisting of MP335N, cobalt-chromium alloys, NiTi alloys, ceramics, glasses, or polymeric materials.

37. The tissue cutting member of claim 2 wherein the flared distal section and the cylindrically shaped proximal section meet at a junction.

38. An elongated probe member for a biopsy or other tissue cutting device comprising:

a. an elongated outer cannula having a distal tip, a tissue receiving aperture in a wall of the outer cannula spaced proximally from the distal tip with an inner tissue cutting edge and inner lumen in fluid communication with and extending proximally from the tissue receiving aperture; and

b. a tissue cutting member for separating tissue from a target site within a patient's body which is slidably disposed within the inner lumen of the outer cannula and which comprises:

i. a distal tubular portion having a distal tip with an outer tissue cutting edge, an inner tissue receiving aperture and a longitudinal axis,

ii. a longitudinally oriented opening in the distal tubular portion that has an open distal end which opens to the inner tissue receiving aperture and a closed proximal end, and

iii. at least a second opening in a wall of the distal tubular portion circumferentially spaced from the longitudinally oriented opening about the longitudinal axis.

39. The elongated probe member of claim 38 wherein the distal tip of the distal tubular portion has a beveled front face.

40. The elongated probe member of claim 39 wherein the beveled front face has a leading edge and a trailing edge.

41. The elongated probe member of claim 40 wherein the longitudinally oriented opening in the distal portion of the tubular member opens to the trailing edge of the beveled front face.

42. The elongated probe member of claim 40 wherein the distal leading edge of the beveled front face contacts the inner tissue cutting edge of the tissue receiving aperture.