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Bridle delivery system having reduced-contact bridle

Abstract

A securement device for a system for securing a nasal tube is provided. The securement device includes a bridle having a body extending between a first end and a second end. The body has a lobed or star shape. The securement device further includes a magnetic connection portion disposed at the first end of the bridle. A system for securing a nasal tube can include a securement device as described above, and a retrieval probe. The retrieval probe can include a catheter extending between a proximal end and a distal end; and a magnetic tip disposed at the proximal end. The magnetic connection portion of the bridle and the magnetic tip of the retrieval probe can be configured to magnetically couple during a procedure for inserting the bridle in a nasal passageway of a patient.

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Background/Summary

FIELD OF THE INVENTION

(1) The subject matter of the present invention relates generally to a system for securing a nasal tube including a reduced-contact bridle.

BACKGROUND

(2) The use of nasal tubes is commonly required in a medical setting, and many methods of securing nasal tubes that have been placed are known in the art. Generally, a nasal tube which has been inserted into a nostril may extend into a patient's stomach, intestinal tract, or lungs. Typically, once the nasal tube is in place, it is important to secure the tube. It should be appreciated that failing to properly secure a nasal tube can result in a dangerous situation for a patient, as well as increasing the cost of care, for example, by requiring repositioning of the nasal tube and re-securing the nasal tube.

(3) There are various existing systems and methods for securing a nasal tube. For example, a nasal tube may be secured using a bridle being placed around the vomer bone. A clinician may place the bridle using a long flexible member, such as a tube, including the bridle and a magnet at the distal end, which is held together by the clinician's grasp. The long flexible member is inserted into one

nostril, into the naval cavity towards the rear of the vomer bone. A retrieval probe with a magnet at the distal end is inserted into the other nostril to allow the magnets to contact each other around the vomer bone. Once the magnets have made contact, the clinician lets go of the bridle to allow the long flexible member to enter the nostril, and the probe is pulled outward, which pulls the long flexible member including the bridle around the vomer bone. With the bridle looped around the vomer bone and extending from both nostrils, the bridle may be secured with a clamp, which may have a channel to accept the nasal tube to secure the nasal tube. For example, the channel can have a smaller inside diameter than the outside diameter of the nasal tube, which provides for a tight fit of the nasal tube in the channel and allows the nasal tube to not fall out of the clamp prior to closing the clamp. The clinician may bring the clamp as close to the nostril as possible and press the tube into the tight channel in the clamp, place the bridle into the clamp, and close the clamp to secure the nasal tube to the bridle.

(4) Existing nasal bridling devices for nasal tube securement typically rely on two catheters inserted into the nares past the vomer bone with magnets at the tip of each catheter to facilitate connection between the catheters behind the vomer bone and pass through of a tether through both nares. Typically, the first catheter may be the securement device or bridle, and the second catheter may be the retrieval probe. Existing bridle catheters typically rely on ribbon or tubular design profiles which reside in the nasal cavity when securing a nasal device. Such ribbon or tubular design profiles of the bridle catheter can allow for increased contact area with the surrounding delicate tissues of the nasal passageways. Additionally, the ribbon or tubular shaped bridle catheters can easily twist while in place within the nasal passageways. Some existing nasal bridle catheters can be formed from a polyester braid, which braided material can include openings therein in which bacteria may accumulate. Thus, such existing ribbon or tubular designs can increase the potential for tissue ulceration, infection, or necrosis, thereby potentially increasing medical costs, time of treatment, and pain for patients.

(5) Consequently, there is a need for an improved bridle delivery system having a bridle with reduced contact area. In particular, an improved bridle delivery system that reduces the probability for twisting of the bridle would also be useful.

SUMMARY

(6) Objects and advantages of the invention will be set forth in part in the following description, or may be obvious from the description, or may be learned through practice of the invention.

(7) The present invention is directed to a securement device for a system for securing a nasal tube. The securement device includes a bridle having a body extending between a first end and a second end. The body comprises a lobed or star shape comprising a plurality of outer protrusions. The securement device further includes a magnetic connection portion disposed at the first end of the body of the bridle.

(8) In one particular embodiment of the securement device, the body of the bridle can include a soft polymer.

(9) In another embodiment, the body of the bridle can include a monofilament extending from the first end to the second end.

(10) In an additional embodiment, the body of the bridle can include a solid core.

(11) In a further embodiment, the plurality of outer protrusions comprises three outer protrusions.

(12) In yet another embodiment, the outer protrusions can each have an approximately equal radius of curvature. Further, a ratio of a radius of the body of the bridle to the radius of curvature of the outer protrusions can be in a range from about 3:1 to about 5:1.

(13) In still another embodiment, the body of the bridle can include at least one minor peak between each outer protrusion. Moreover, each minor peak can have a radius of curvature, further wherein a ratio of the radius of curvature of each minor peak to the radius of curvature of the outer protrusions can be in a range from 1.5:1 to about 3:1. Further, the bridle can include at least one valley disposed between each outer protrusion and the at least one minor peak.

(14) In an additional embodiment, the magnetic connection portion can include a connecting member and magnetic connection member, wherein the magnetic connection member can include a permanent magnet or a material configured to magnetically couple to a permanent magnet that is not a permanent magnet. Moreover, the magnetic connection member can include an exposed end extending distally outward from a distal end of the connecting member. Further, the connecting member can be overmolded over the magnetic connection member. Moreover, the connecting member can be overmolded over a connection end of the body of the bridle.
(15) The present invention is further directed to a system for securing a nasal tube. The system includes a bridle comprising a body extending between a first end and a second end, wherein the body comprises a lobed or star shape. The system further includes a magnetic connection portion attached to the bridle. The system further includes a retrieval probe. The retrieval probe includes a proximal end and a distal end; a catheter between the proximal end and the distal end; and a magnetic tip disposed at the proximal end. The magnetic connection portion of the bridle and the magnetic tip of the retrieval probe are configured to magnetically couple during a procedure for inserting the bridle in a nasal passageway of a patient.
(16) In one particular embodiment of the system, either the magnetic connection portion of the bridle or the magnetic tip of the retrieval probe can include a permanent magnet. Moreover, the other of the magnetic connection portion of the bridle or the magnetic tip of the retrieval probe can include a magnetically connective material that is not a permanent magnet.
(17) In another embodiment, the magnetic connection portion of the bridle and the magnetic tip of the retrieval probe each can include a permanent magnet.
(18) These and other features, aspects, and advantages of the present invention will become better understood with reference to the following description and appended claims. The accompanying drawings, which are incorporated in and constitute a part of this specification, illustrate embodiments of the invention and, together with the description, serve to explain the principles of the invention.

Description

BRIEF DESCRIPTION OF THE DRAWINGS
(1) A full and enabling disclosure of the present invention, including the best mode thereof, directed to one of ordinary skill in the art, is set forth in the specification, which makes reference to the appended figures, in which:
(2) FIG. **1** illustrates a perspective view of a securement device including a bridle catheter according to one particular embodiment of the present invention;
(3) FIG. **2** illustrates a cross-sectional view of the bridle catheter of FIG. **1**;
(4) FIG. **3** illustrates a side cut-away view of the securement device of FIG. **1**;
(5) FIG. **4**A illustrates a cross-sectional view of a lobed-shape having three protrusions and two points of contact to a tangent line;
(6) FIG. **4**B illustrates a cross-sectional view of a lobed-shape having four protrusions and two points of contact to a tangent line;
(7) FIG. **4**C illustrates a cross-sectional view of a star-shape having seven protrusions and two points of contact to a tangent line;
(8) FIG. **4**D illustrates a cross-sectional view of an oval or tubular shape having a single elongated point of contact to a tangent line;
(9) FIG. **4**E illustrates a cross-sectional view of a ribbon-shape having a single elongated point of contact to a tangent line;
(10) FIG. **5** illustrates a side view of an exemplary embodiment of a retrieval probe of the system for securing a nasal tube of the present invention.

DETAILED DESCRIPTION

(11) Reference now will be made in detail to embodiments of the invention, one or more examples of which are illustrated in the drawings. Each example is provided by way of explanation of the invention, not limitation of the invention. In fact, it will be apparent to those skilled in the art that various modifications and variations can be made in the present invention without departing from the scope or spirit of the invention. For instance, features illustrated or described as part of one embodiment can be used with another embodiment to yield a still further embodiment. Thus, it is intended that the present invention covers such modifications and variations as come within the scope of the appended claims and their equivalents.

(12) As used herein, the terms “about,” “approximately,” or “generally,” when used to modify a value, indicates that the value can be raised or lowered by 5% and remain within the disclosed embodiment. Further, when a plurality of ranges are provided, any combination of a minimum value and a maximum value described in the plurality of ranges are contemplated by the present invention. For example, if ranges of “from about 20% to about 80%” and “from about 30% to about 70%” are described, a range of “from about 20% to about 70%” or a range of “from about 30% to about 80%” are also contemplated by the present invention.

(13) Generally speaking, the present invention is directed to a securement device for a system for securing a nasal tube. The securement device includes a bridle having a body extending between a first end and a second end. The body has a lobed or star shape. The securement device further includes a magnetic connection portion disposed at the first end of the bridle. The present inventors have found that by providing a lobe or star shaped body of the bridle, both the size of contact area(s) between the body of the bridle and the patient's nasal tissues and the likelihood of twisting of the bridle can be reduced. In turn, the present inventors have found that the likelihood of abrasion, trauma, and necrosis of the patient's tissue resulting from contact between the bridle and the patient's tissue can be reduced. Additionally, the magnetic connection portion can have an exposed portion of magnetically connective material. The present inventors have found that the exposure of the magnetically connective connection member at the distal end of the retrieval probe increases the exposure of a magnetic surface to facilitate a stronger connection between the retrieval probe and a coupling member, such as a securement device, without sacrificing patient safety.

(14) The specific features of the bridle securement device and the system for securing a nasal tube of the present invention may be better understood with reference to FIGS. **1**-**5**.

(15) Referring now to FIG. **1**, one embodiment of a securement device **200** for a system for securing a nasal tube is shown. The securement device **200** includes a bridle (sometimes described as a “bridle catheter”) **202** and a magnetic connection portion **204**. The bridle **202** includes a body **210** having an outer surface **212**. The body **210** can have a length L extending from a free end **217** to a connection end **216**. The length L of the body **210** may be sufficiently long to extend through a first nare, around the vomer bone, through the second nare of a patient, and be secured, e.g., by tying, securement with a clip, or other means. For instance, the length L may be in a range from about 15 inches (38 cm) to about 30 inches (76 cm), such as from about 18 inches (46 cm) to about 28 inches (71 cm), for instance from about 20 inches (51 cm) to about 25 inches (64 cm). In a particular embodiment of the securement device **200**, the body **210** can have a length L of about 22+/−0.25 inches (55.9+/−0.64 cm).

(16) As shown in FIGS. **1** and **2**, the body **210** of the bridle **202** may be formed with solid construction. In other words, the body **210** may not include any lumen(s) or open areas within the outer surface **212** of the body **210**. For instance, the body **210** can be formed as a monofilament. Suitable materials for the body **210** of the bridle **202** include thermoplastic elastomers such as polyolefins, including polyethylene and polypropylene, polyamides, polyimides, teflon (polytetrafluoroethylene), polyesters, polyurethanes, any copolymers thereof, and other materials known in the art. In some particular embodiments, the body **210** can be formed from a soft (i.e.,

non-rigid) polymer, for example polyurethane and/or a polyurethane blend. The solid construction of the body **210** of the bridle **202** can be formed, e.g., by extrusion. For instance, in some aspects of the invention, a solid inner core **214** having, e.g., a cylindrical shape, can be extruded and the body **210** of the bridle **202** can be extruded over the inner core **214**.

(17) The present inventors have found that forming the bridle **202** as a monofilament of solid construction may reduce the risk of bacterial accumulation along the bridle **202** as compared to existing nasal bridles formed of a tubular or braided construction. In particular, because the solid monofilament construction does not include any openings, apertures or other unexposed surfaces, the likelihood of bacteria growing alongside the bridle **202** may be reduced. In contrast, existing nasal bridles of tubular construction can potentially allow bacteria to enter or grow within an inner lumen of the tubular construction. Similarly, existing nasal bridles formed from a braided construction are formed with many crevices between pieces of braided material along outer and inner surfaces of the bridle, forming many surfaces and crevices in which bacteria may colonize.

(18) The outer surface **212** of the body **210** of the bridle **202** can have a shape defining at least three protrusions **220**. For instance, the outer surface **212** of the body **210** can have a lobed shape or a star shape. In a particular embodiment of the present invention illustrated in FIGS. **1-2**, the outer surface **212** of the body **210** can have a tri-lobed shape having three outer protrusions **220**. The outer protrusions **220** can be substantially equally spaced around a center point **240** of the body **210**. Each outer protrusion **220** can include an outermost contact point **222** at a point of the outer protrusion **220** on the outer surface **212** furthest from the center point **240**. The body **210** of the bridle **202** can have a radius **234** extending from the center point **240** to a contact point **222** of each outer protrusion **220**. The radius **24** can be approximately equal within each respective outer protrusion **220**. The radius **234** can be in a range from about 0.015 inches (0.38 mm) to about 0.055 inches (1.40 mm), such as from about 0.02 inches (0.51 mm) to about 0.05 inches (1.27 mm), for instance from about 0.03 inches (0.76 mm) to about 0.04 inches (1.02 mm). Each of the contact points **222** can be connected by an imaginary circle **235** extending around the body **210**. The imaginary circle **235** can have a diameter **236** in a range from about 0.04 inches (1.02 mm) to about 0.1 inches (1.54 mm), such as from about 0.05 inches (1.27 mm) to about 0.09 inches (2.29 mm), such as from about 0.06 inches (1.52 mm) to about 0.08 inches (2.03 mm). Importantly, the radius **234** extending from the center point **240** to a contact point **222** can be equal to the radius (i.e., one half of the diameter **236**) of the imaginary circle **235**.

(19) At the contact point **222** of each outer protrusion **220**, the outer protrusion **220** can have a radius of curvature **224**. The radius of curvature **224** of the outer protrusion **220** can be in a range from about 0.005 inches (0.13 mm) to about 0.015 inches (0.38 mm), such as from about 0.007 inches (0.18 mm) to about 0.012 inches (0.30 mm), for instance from about 0.008 inches (0.20 mm) to about 0.01 inches (0.25 mm).

(20) A ratio of the radius **234** of the body **210** to the radius of curvature of the **224** of the outer protrusions **220** can be in a range from about 3:1 to about 5:1, such as from about 3.25:1 to about 4.5:1, for instance from about 3.5:1 to about 4.25:1. By providing outer protrusions **220** that have a significantly smaller radius of curvature **224** than the body **210**, e.g., about three to five times smaller, the area of the contact points **222** which may contact the patient's tissues can be substantially reduced, as compared to a tubular (e.g., circular) or ribbon-shaped (e.g., rectangular) bridle. As a result, the possibility of tissue damage due to abrasion between the bridle **202** and the patient's tissue can be minimized.

(21) Additionally, as best illustrated in FIG. **2**, between outer protrusions **220**, the outer surface **212** of the body **210** of the bridle **202** may include a minor peak **226**. Further, a valley **230** may be formed between each minor peak **226** and protrusion **220**. In some aspects of the invention, there can be a minor peak **226** in between each outer protrusion **220**. By providing a minor peak **226** between each outer protrusion **220**, the depth of the valleys **230** can be minimized such that there is less space for debris or buildup, e.g., bacteria, to accumulate between the outer protrusions **220**.

The minor peaks **226** can each have a radius of curvature **228** in a range from about 0.015 inches (0.38 mm) to about 0.022 inches (0.56 mm), such as from about 0.016 inches (0.41 mm) to about 0.021 inches (0.53 mm), for instance from about 0.017 inches (0.43 mm) to about 0.019 inches (0.48 mm). The valleys **230** can each have a radius of curvature **232** in a range from about 0.016 inches (0.41 mm) to about 0.025 inches (0.64 mm), such as from about 0.018 inches (0.46 mm) to about 0.022 inches (0.56 mm), for instance from about 0.019 inches (0.48 mm) to about 0.021 inches (0.53 mm).

(22) A ratio of the radius of curvature **228** of the minor peaks **226** to the radius of curvature **232** of the valleys **230** can be in a range from about 0.75:1 to about 1:1, for instance about 0.9:1. Additionally, a ratio of the radius of curvature **228** of the minor peaks **226** to the radius of curvature **224** of the outer protrusions **220** can be in a range from about 1.5:1 to about 3:1, for instance about 2:1.

(23) As illustrated in FIGS. **4**A-E, a lobed or star-shaped design can result in providing at least two contact points along a surface. For instance, a tri-lobed shape **10** similar to that of the body **210** of the bridle **202** shown in FIGS. **1**-**3** is illustrated in FIG. **4**A. The tri-lobed shape **10** includes three protrusions **14**. On a contact surface **2**, e.g., analogous to a patient's tissue, the tri-lobed shape **10** can have two contact points **12** with the contact surface **2**. Similarly, FIG. **4**B illustrates a lobed shape **20** having four protrusions **24** which forms two contact points **22** on a surface **2**. In a similar manner, FIG. **4**C illustrates a star shape **30** having seven protrusions (points) **34** and two contact points **32** on the surface **2**. In contrast, the tubular shape **40** shown in FIG. **4**D includes a single contact point **42** on the surface **2** at a point along a surface of the tubular shape. FIG. **4**E further illustrates a ribbon-shape, e.g., a rectangle, **50** which has a single contact plane **52** along the surface **2** that extends an entire length of a side of the rectangle. In comparison to the shapes illustrated in FIGS. **4**A-D, the ribbon or rectangular shape **50** shown in FIG. **4**E has the largest contact surface. In a bridle formed with the shape **50**, the bridle would have an expansive contact area with a patient's tissue, which may cause more abrasion with the patient's tissue in an undesirable manner.

(24) Moreover, the present inventors have found that providing a lobed or star shaped construction for the body **210** of the bridle **202** can reduce twisting of the body **210** of the bridle **202**. In particular, the solid construction of the lobed or star shape can resist twisting around a longitudinal axis (e.g., an axis formed through the center point **240**). Thus, in a circumstance in which the body **210** of the bridle **202** becomes twists, the body **210** is likely to inherently right itself due to the shape of the body **210** resisting the twisting forces.

(25) Turning now to FIG. **3**, the magnetic connection portion **204** of the securement device **200** is illustrated in further detail. A connecting member **260** is provided which connects the connection end **216** of the bridle **202** to a magnetic connection member **250** such as a permanent magnet. The connecting member **260** can include a bridle portion **266** in which the connection end **216** of the bridle **202** can be disposed. The bridle portion **266** may have a diameter **268**. The diameter **268** of the bridle portion **266** may be greater than the diameter **236** of the imaginary circle **235** that circumscribes the contact points **222** of the bridle **202**. In some aspects of the present invention, the bridle portion **266** can be overmolded over the connection end **216** of the bridle **202** to permanently couple the connecting member **260** and the bridle **202**; however, any suitable method of attaching the connecting member **260** to the bridle **202** can be used.

(26) At an opposite end of the magnetic connection portion **204** from the bridle portion **266**, the magnetic connection portion **204** includes a magnet portion **262**. The magnetic connection member **250** can be disposed within the magnet portion **262**. For instance, the magnetic connection member **250** can be formed from a permanent magnet, a rare earth magnet, or any suitable material to provide for magnetic coupling with a cooperating magnetic coupling. The magnetic connection member **250** can have a generally cylindrical shape having a diameter **280**. The diameter **280** can be in a range from about 0.09 inches (about 2.3 mm) to about 0.11 inches (about 2.8 mm), such as about 0.1 inches (about 2.5 mm).

(27) The magnetic connection member **250** includes an enclosed portion **258** disposed within the connecting member **260** and an exposed section **252** which extends beyond a distal end **276** of the connecting member **260**. The exposed section **252** of the magnetic connection member **250** can include a lateral surface **254** and an end surface **156** disposed generally perpendicular to the lateral surface **254**. The exposed section **252** can have an axial length along the lateral surface **254** in a range from about 0.03 inches (about 0.6 mm) to about 0.1 inches (about 2.5 mm), such as from about 0.04 inches (about 1 mm) to about 0.07 inches (about 1.8 mm), such as from about 0.045 inches (about 1.1 mm) to about 0.055 inches (about 1.4 mm). The magnetic connection member **250** can have an overall length **278** in a range from about 0.12 inches (about 3.05 mm) to about 0.25 inches (about 6.35 mm), such as from about 0.15 inches (about 3.81 mm) to about 0.2 inches (about 5.08 mm), for instance, from about 0.18 inches (about 4.57 mm) to about 0.192 inches (about 4.88 mm).
(28) A ratio of the length of the exposed section **252** to an overall length **278** of the magnetic connection member **250** can be in a range from about 1:5 to about 1:2, such as from about 1:4 to about 1:3. Notably, the length of the exposed section **252** may be generally about two to three times larger than a length of an exposed section of magnet of prior art bridle connection devices. The present inventors have found that the increased length of the exposed section **252** of the magnetic connection portion **204** of the securement device **200** of the present invention can allow for overall increased exposure of the magnetically connective surface of the magnetic connection portion **204** along the lateral surface **254**, thereby facilitating a stronger magnetic connection between the magnetic connection portion **204** of the securement device **200** and a cooperating device, such as a retrieval probe, without compromising patient safety.
(29) The magnet portion **262** of the connecting member **260** can have a diameter **264** that is greater than the diameter **280** of the magnetic connection member **250** such that the magnet portion **262** surrounds the magnetic connection member **250** along the length of the magnet portion **262**. In some aspects of the present invention, the magnet portion **262** can be overmolded over the magnetic connection member **250** to permanently couple the magnet portion **262** and the magnetic connection member **250**; however, any suitable method of attaching the magnetic connection member **250** can be used.
(30) Moreover, as shown in FIG. **3**, the diameter **264** of the magnet portion **262** can be greater than the diameter **268** of the bridle portion **266**. Further, the connecting member **260** can have an intermediate portion **272** disposed between the magnet portion **262** and the bridle portion **266**. A diameter of the intermediate portion **272** of the connecting member **260** can be different from the diameter **264** of the magnet portion **262** and the diameter **268** of the bridle portion **266**. Moreover, as shown in FIG. **3**, the connecting member **260** may include a first shoulder **270** disposed between the bridle portion **266** and the intermediate portion **272**, and a second shoulder **274** disposed between the intermediate portion **272** and the magnet portion **266**. The first shoulder **270** and second shoulder **274** can form a stepped, e.g., step-up or step-down, configuration along the connecting member **260**. However, in other aspects of the invention, the connecting member **260** may have a tapered diameter along all or a portion of its length. A tapered configuration may be combined with the stepped arrangement described above. Moreover, in further aspects of the present invention, the connecting member **260** may have a constant diameter along its length such that the diameter **264** of the magnet portion **262** and the diameter **268** of the bridle portion **266** are the same.
(31) As shown in FIG. **3**, the connecting member **260** can be formed of unitary, i.e., one-piece, construction to attach the magnetic connection member **250** to the connection end **216** of the bridle **202**. For instance, the connecting member **260** can be an overmolded structure that is overmolded over both the connection end **216** of the bridle **202** and the magnetic connection member **250**. In some aspects, the connecting member **260** can be simultaneously overmolded over both the connection end **216** of the bridle **202** and the magnetic connection member **250**. The connecting

member **260** can be formed of any suitable material. For instance, in some aspects of the present invention the connecting member **260** may be formed from polyvinyl acetate (PVA).
(32) Turning now to FIG. **5**, an exemplary retrieval probe **100** is illustrated. The retrieval probe **100** may be a part of the system for securing a nasal tube of the present invention. The retrieval probe **100** can include an elongated member **106** that extends between a proximal end **102** and a distal end **104**. The retrieval probe **100** includes a handle **108** at the proximal end **102**, and a magnetic tip **110** at the distal end **104**. The elongated member **106** of the retrieval probe **100** may be approximately 5 inches (about 12.7 cm) long, with the handle **108** being approximately 1 inch (about 2.54 cm) long. A magnetic tip **110** can be disposed at the distal end **104** of the retrieval probe **100**. The magnetic tip **110** can include a connection member **154**, e.g., a magnet or a magnetically connective material. The connection member **154** can be formed from a permanent magnet, a rare earth magnet, or any suitable material to provide for magnetic coupling with a cooperating magnetic coupling. For instance, when the securement device **200** includes a magnetic connection member **250** formed from a permanent magnet, the connection member **154** can be formed from a permanent magnet having opposite polarity, or a material configured to magnetically couple to a permanent magnet that is not a permanent magnet. An example of such material can be stainless steel or any other suitable material having low magnetic reluctance. Alternatively, when the connection member **154** includes a permanent magnet, the magnetic connection member **250** of the retrieval probe of the present invention can be formed from a material configured to magnetically couple to a permanent magnet that is not a permanent magnet, such as stainless steel.
(33) In use, the securement device **200** can be inserted into a first nostril, e.g., by inserting the securement device **200** within a delivery probe (not shown) and inserting the delivery probe into the first nostril. The magnetic connection portion **204** of the securement device **200** can be inserted towards the rear of the vomer bone of a patient through the first nostril. Then, the retrieval probe **100** can be inserted into a second nostril, with the connection member **154** exposed at the distal end **102** of the retrieval probe **100** and inserted towards the rear of the vomer bone of the patient within the second nostril. The magnetic connection portion **204** of the securement device **200** and the connection member **154** of the retrieval probe **100** can be magnetically coupled behind the patient's vomer bone. For instance, the body **210** of the bridle **202** and/or the elongated member **106** of the retrieval probe **100** can bend or flex behind the vomer bone as the magnetic attraction between the connection member **154** and the magnetic connection portion **204** increases to bring the connection member **154** and the magnetic connection portion **204** together. After the magnetic connection portion **204** and the connection member **154** are coupled, the retrieval probe **100** is removed from the second nostril, such that the body **210** of the bridle **202** extends into the first nostril and out from the second nostril. If applicable, the delivery probe is then removed from the first nostril. For example, when the retrieval probe **100** is removed from the second nostril, the body **210** of the bridle **202** is left hanging out of both nostrils. Then, the bridle **202** can be secured using any suitable means. Moreover, a nasal tube can be inserted and/or secured to the bridle using any suitable means to secure the nasal tube within the patient's nose and deter or discourage the patient from pulling on the nasal tube.
(34) This written description uses examples to disclose the invention, including the best mode, and also to enable any person skilled in the art to practice the invention, including making and using any devices or systems and performing any incorporated methods. The patentable scope of the invention is defined by the claims and may include other examples that occur to those skilled in the art. Such other examples are intended to be within the scope of the claims if they include structural elements that do not differ from the literal language of the claims or if they include equivalent structural elements with insubstantial differences from the literal language of the claims.

Claims

1. A securement device for a system for securing a nasal tube comprising: a bridle having a body extending between a first end and a second end, wherein the body comprises a lobed shape comprising at least three outer protrusions about a circumference of the body; and a magnetic connection portion disposed at the first end of the body of the bridle; wherein the body of the bridle comprises at least one minor peak between each outer protrusion; and wherein an outer diameter of the body defined at the minor peak is less than an outer diameter of the body defined at the outer protrusions.
2. The securement device of claim 1, wherein the body of the bridle comprises a soft polymer.
3. The securement device of claim 1, wherein the body of the bridle comprises a monofilament extending from the first end to the second end.
4. The securement device of claim 1, wherein a cylindrical inner core is composed of a solid material and integrally coupled to the body of the bridle.
5. The securement device of claim 1, wherein the at least three outer protrusions comprises exactly three outer protrusions.
6. The securement device of claim 1, wherein the at least three outer protrusions each have an approximately equal radius of curvature.
7. The securement device of claim 6, wherein of a radius of the body of the bridle is greater than to the radius of curvature of the at least three outer protrusions such that a contact area defined by the radius of curvature of the body is reduced.
8. The securement device of claim 1, wherein each minor peak has a radius of curvature greater than a radius of curvature of the at least three outer protrusions.
9. The securement device of claim 1, further comprising at least one valley disposed between each outer protrusion and the at least one minor peak.
10. The securement device of claim 1, wherein the magnetic connection portion comprises a connecting member and a magnetic connection member, wherein the magnetic connection member comprises a permanent magnet or a material configured to magnetically couple to a permanent magnet that is not a permanent magnet.
11. The securement device of claim 10, wherein the magnetic connection member comprises an exposed end extending distally outward from a distal end of the connecting member, wherein an outer surface of the connecting member includes a first shoulder and a second shoulder forming a decreasing stepped surface extending longitudinally between the magnetic connection member and the body of the bridle.
12. The securement device of claim 10, wherein the connecting member is overmolded over the magnetic connection member, wherein the connecting member is overmolded over the magnetic connection member.
13. The securement device of claim 10, wherein the connecting member is overmolded over a connection end of the body of the bridle.
14. A system for securing a nasal tube comprising: a bridle comprising a body extending between a first end and a second end, wherein the body comprises a lobed shape having at least three outer protrusions about a circumference of the body, wherein the body of the bridle comprises at least one minor peak between each outer protrusion; and wherein an outer diameter of the body defined at the minor peak is less than an outer diameter of the body defined at the outer protrusions; a magnetic connection portion attached to the bridle; and a retrieval probe, the retrieval probe comprising: a proximal end and a distal end; a catheter between the proximal end and the distal end; and a magnetic tip disposed at the proximal end, wherein the magnetic connection portion of the bridle and the magnetic tip of the retrieval probe are configured to magnetically couple during a procedure for inserting the bridle in a nasal passageway of a patient.
15. The system of claim 14, wherein either the magnetic connection portion of the bridle or the magnetic tip of the retrieval probe comprises a permanent magnet.

16. The system of claim 15, wherein the other of the magnetic connection portion of the bridle or the magnetic tip of the retrieval probe comprises a magnetically connective material that is not a permanent magnet.
17. The system of claim 14, wherein the magnetic connection portion of the bridle and the magnetic tip of the retrieval probe each comprises a permanent magnet.
18. The system of claim 14, the magnetic connection portion comprising a magnetic connection member partially extending beyond a connecting member, wherein a ratio of a length of an exposed section of the magnetic connection member to an overall length of the magnetic connection member is a range from about 1:5 to about 1:2.
19. The securement device of claim 1, wherein the three outer protrusions are configured to resist twisting of the body around a longitudinal axis of the body.
20. The securement device of claim 1, wherein the body is of solid construction and does not define any openings or apertures; wherein the at least three outer protrusions have a semicircular cross-sectional shape and extend parallel to a longitudinal axis of the body, the outer protrusions extending between the first end and the second end of the body; wherein the body comprises a cylindrical inner core extending between the first end and the second end along the longitudinal axis; and wherein the body defines a smooth outer surface and resists bacterial accumulation.