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(19) **United States**(12) **Patent Application Publication**
Fobi et al.(10) **Pub. No.: US 2014/0051914 A1**(43) **Pub. Date: Feb. 20, 2014**(54) **GASTRIC BYPASS BAND AND SURGICAL METHOD****Publication Classification**(71) Applicant: **BARIATEC CORPORATION**, Palos Verdes Peninsula, CA (US)(72) Inventors: **Mathias Asongwe Lawrence Fobi**, Rolling Hills, CA (US); **C. Bruce Fields**, Roseville, CA (US)(73) Assignee: **Bariathec Corporation**, Palos Verdes Peninsula, CA (US)(21) Appl. No.: **13/767,354**(22) Filed: **Feb. 14, 2013****Related U.S. Application Data**

(63) Continuation of application No. 13/053,018, filed on Mar. 21, 2011, now Pat. No. 8,469,978, which is a continuation of application No. 10/876,397, filed on Jun. 24, 2004, now Pat. No. 7,909,839.

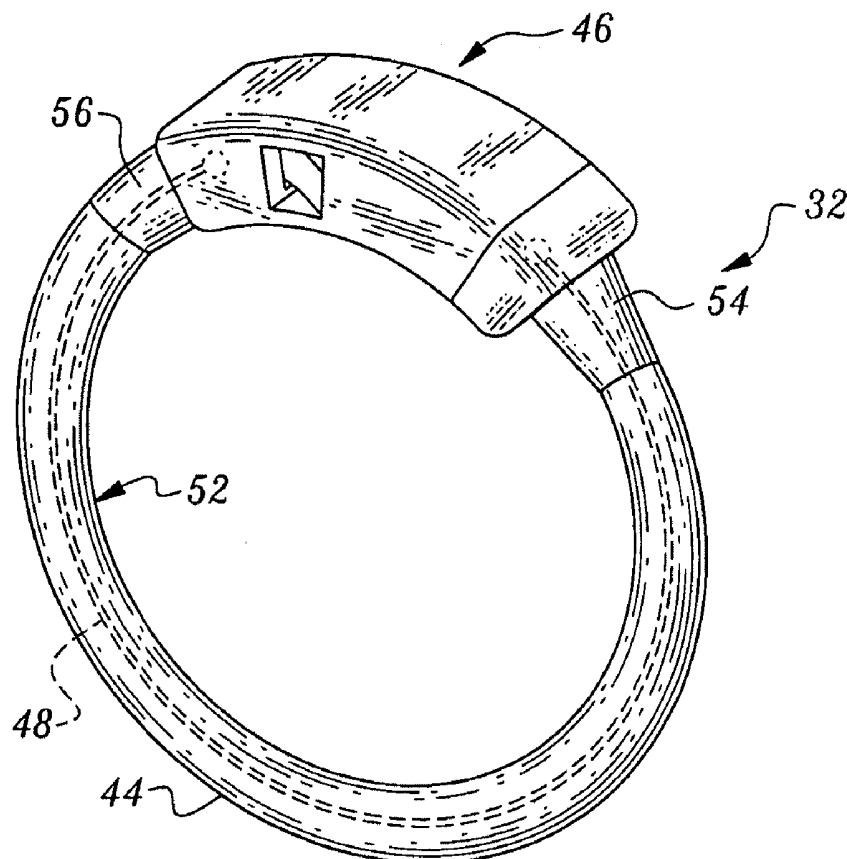
(60) Provisional application No. 60/574,741, filed on May 26, 2004.

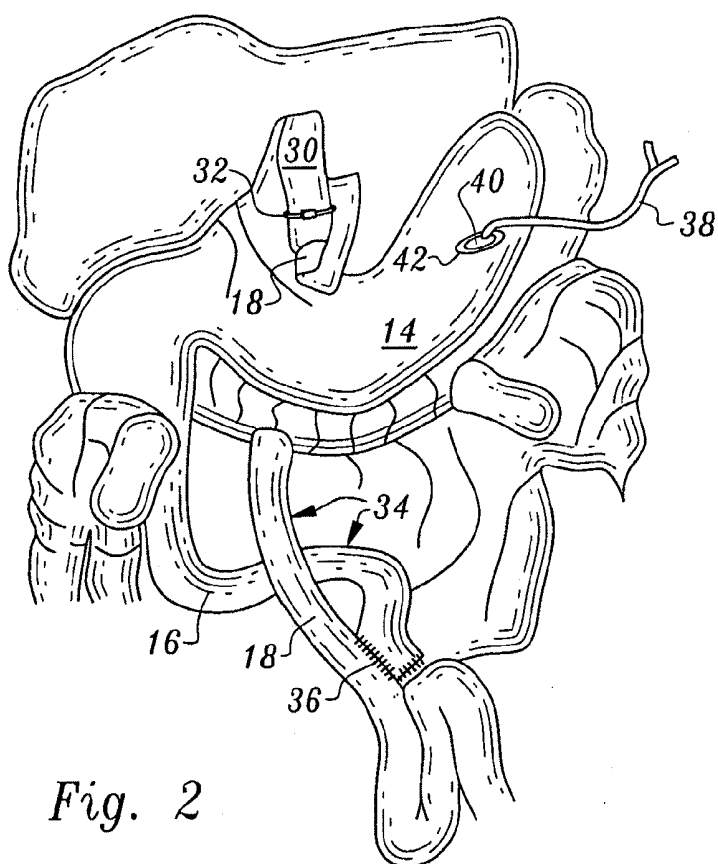
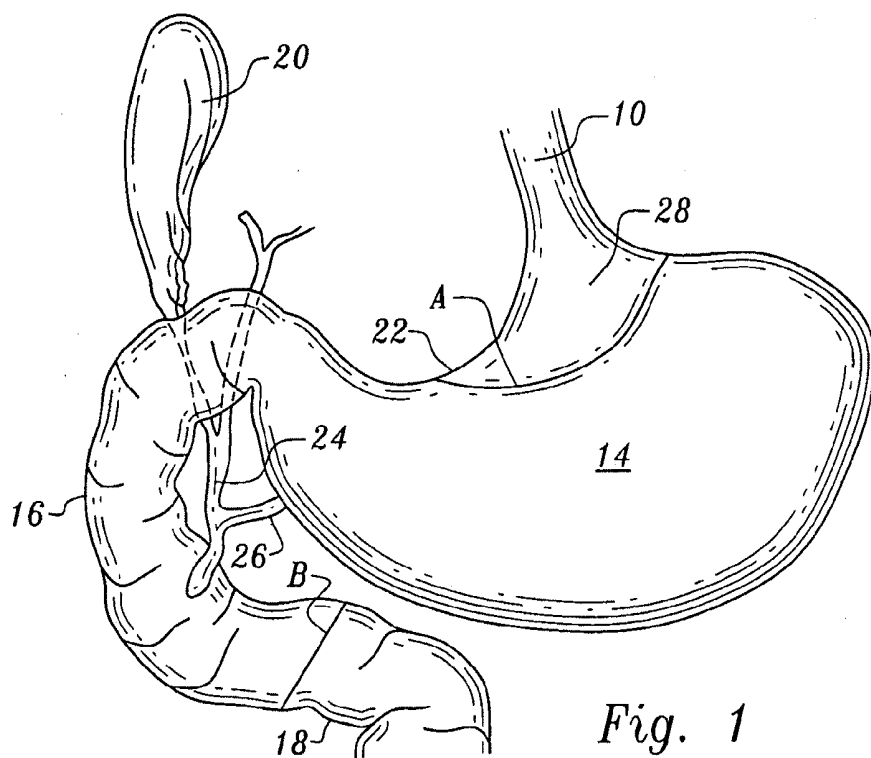
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(57)

ABSTRACT

The present invention relates to a nano-enhanced device for substance transfer between the device and a tissue. The device comprises a substrate with substantially aligned carbon nanotubes anchored within the substrate, and with at least one end of the carbon nanotubes protruding from the substrate. The protruding nanotube ends may be coated with a drug for delivery of the drug into body tissue. The present invention may be incorporated into an angioplasty catheter balloon or into a patch that is worn on the skin. The carbon nanotubes can be grouped in clusters to effectively form nano-needles which can transfer fluid to or from the subdermal tissue. The nano-needles can be used in conjunction with a sensor to ascertain body fluid information such as pH, glucose level, etc.





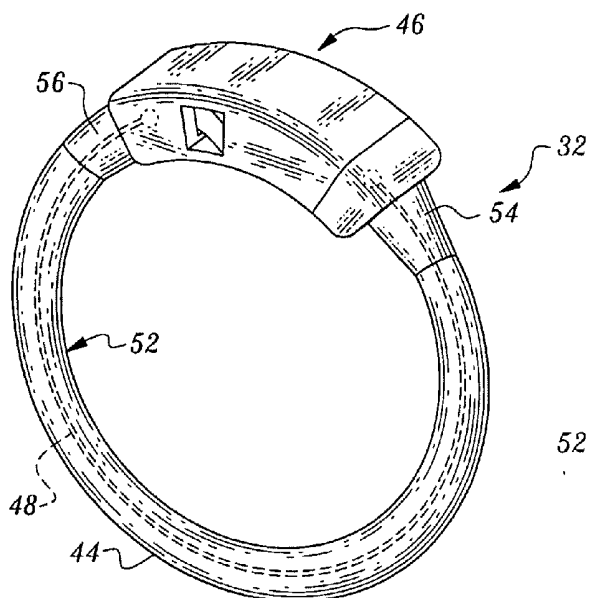


Fig. 3

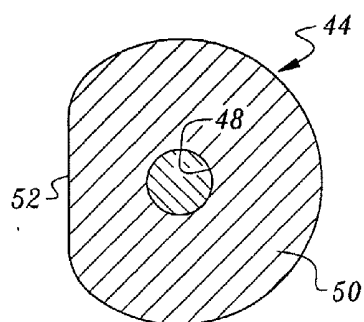


Fig. 4

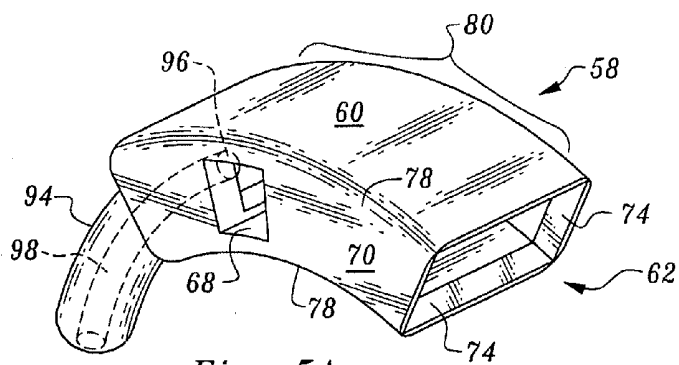


Fig. 5A

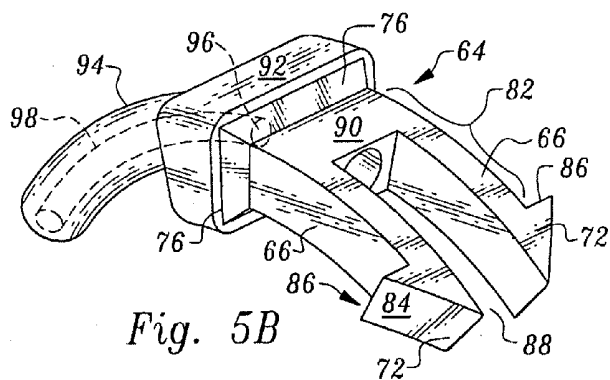


Fig. 5B

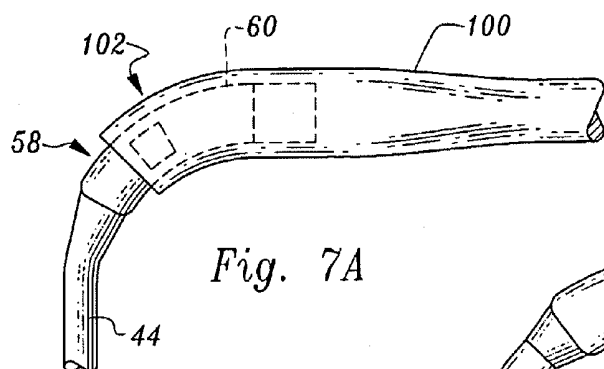


Fig. 7A

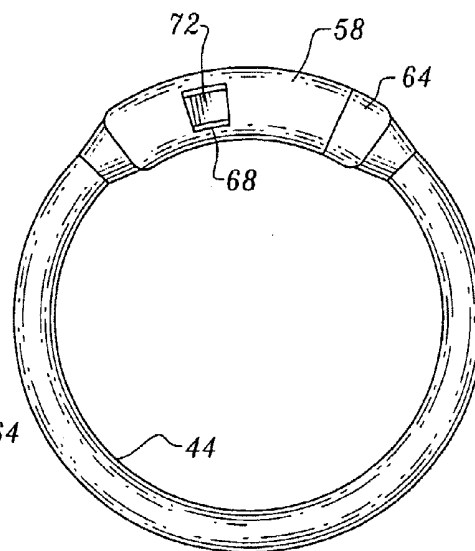


Fig. 6

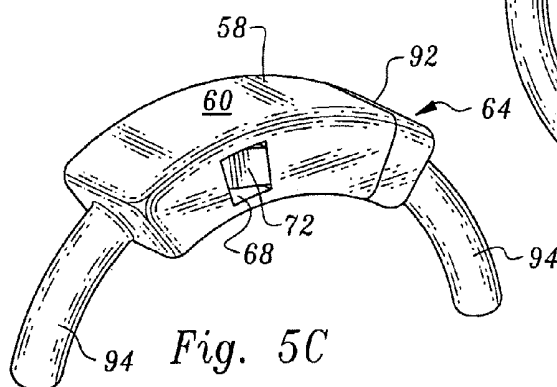


Fig. 5C

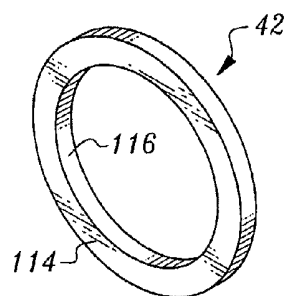


Fig. 8

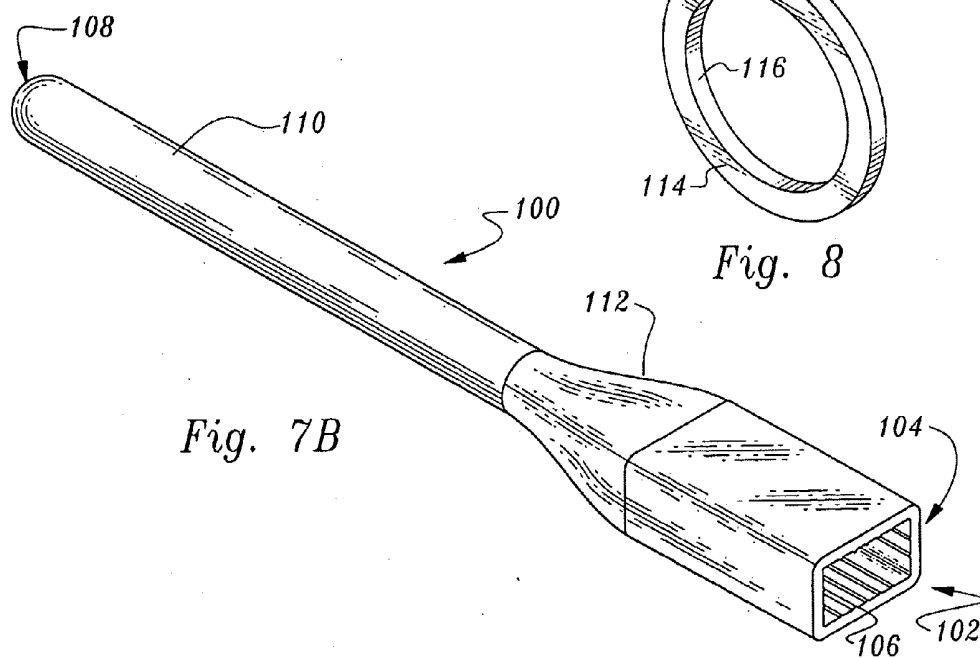


Fig. 7B

GASTRIC BYPASS BAND AND SURGICAL METHOD

CROSS REFERENCE TO RELATED APPLICATIONS

[0001] This application is a continuation of U.S. application Ser. No. 13/053,018 filed Mar. 21, 2011, which is a continuation of U.S. application Ser. No. 10/876,397 filed Jun. 24, 2004, now U.S. Pat. No. 7,909,839, which claims the benefit of U.S. Provisional Ser. No. 60/574,741 filed on May 26, 2004, which applications are fully incorporated herein by reference.

FIELD OF INVENTION

[0002] The present invention pertains to devices for performing gastric bypass surgery for morbidly obese individuals, and more specifically, to a gastric bypass band which creates a small gastric pouch from the esophagus and a portion of the proximal stomach. This invention also details the gastric bypass surgery method that is performed in conjunction with the application of the gastric bypass band.

BACKGROUND

[0003] In the United States, obesity affects the health of 80 million adults, or 35 per cent of the adult population, according to statistics from the Centers for Disease Control and Prevention. American children are also becoming increasingly affected by obesity, as 9 million, or 15 per cent of the child population has fallen victim to this disease in recent years.

[0004] Morbidly obese individuals are identified as those where the disease of obesity has advanced to where the individual has a Body Mass Index (BMI) of over 40 or a BMI of over 35 along with other "co-morbidities" such as diabetes or high blood pressure. To reach a BMI of 35, a 5-foot-10-inch man or a 5-foot-4-inch woman would need to weigh 243 pounds and 204 pounds, respectively. For these individuals, dieting has often become a futile effort, as while some pounds may be shed, over time it has been found that these pounds are often quickly regained. Due to the health threats posed by their condition, morbidly obese individuals have turned to gastric bypass surgery in increasing numbers as an effective method to lose weight.

[0005] There are a number of methods of gastric bypass surgery, as well as a number of medical appliances which have been developed to assist in the application of these methods. However, most methods of gastric bypass surgery operate on the theme of creating a reduced-size "gastric" pouch" out of the stomach, which remains connected to the small intestine. The pouch restricts the amount of food entering the body to a fraction of what would normally enter an unrestricted stomach. Once the pouch is full, the patient often experiences the same feelings of fullness and satiety as would be experienced with an unrestricted stomach.

[0006] U.S. Pat. No. 5,771,903 issued to Jakobsson involves a method of gastric bypass surgery where the lower part of the esophagus is dissected and a band is applied around the lower part of the esophagus and an upper part of the stomach to form a small gastric pouch which upon filling with minimal food gives the patient a feeling of fullness or satiety. The band is inflatable and serves as a type of restrictor valve to regulate the amount of food passing from the banded upper gastric pouch to the unrestricted lower stomach. The band can

be selectively inflated or deflated, depending upon the amount of food that is desired to be passed from the upper to lower stomach.

[0007] U.S. Pat. No. 6,572,627 issued to Gabbay discloses a system to inhibit the expansion of the stomach. The system involves placing a band about midway along the patient's stomach to create a restricted, smaller stomach. The system also employs a section of webbing that is placed around the upper half of the now restricted stomach. The webbing helps limit the expansion of the upper stomach.

[0008] Other inflatable band devices include the Lap Band™ System from Inamed Health of Santa Barbara, Calif.; the Heliogast™ gastric band from Helioscopie of Vienne Cedex, France; the Midband™ from Medical Innovation Development of Villeurbanne, France; and the Swedish Adjustable Gastric Band (SAGB) from Ethicon Endo-Surgery of the United States. These devices are placed around the stomach at its top or midpoint to create a smaller stomach.

[0009] The Proring® and Siliband® are gastric bands, both from Innovative Obesity Care of Saint Etienne, France, which require that the top of the stomach and esophagus first be stapled to form a small stomach pouch. The Proring® and Siliband® are then placed at the bottom of the pouch to form a restrictor valve for regulating the passage of food materials into the lower stomach. The Proring® has a closeable latch with a male-female engagement which is locked by the placement of a suture. The Siliband is closed and attached with sutures.

[0010] The prior art gastric band devices and their associated medical procedures have a success rate of about 65%, with many patients experiencing weight gain again after 5 years. Also, the following complications can result from existing devices and procedures.

[0011] First, the adjustable band devices can have a cross sectional contact width as large as 1" which has been found to cause the leakage of pouch contents into the peritoneal cavity, should these devices erode into the gastric pouch. The body is unable to form scar tissue around, and seal off, such a wide band device. This erosion problem is serious in that some deaths have occurred, and in lesser cases, these prior art bands have had to be removed, or else additional surgeries were necessary to repair leakage problems.

[0012] Second, the adjustable band devices have a tendency to accidentally enlarge, thereby letting more food through the restricted area than desired, and causing weight gain to return.

[0013] Therefore, a need exists for a gastric bypass band which does not promote leakage of pouch contents into the peritoneal cavity and which further does not accidentally enlarge, thereby allowing weight gain to return.

[0014] The foregoing reflects the state of the art of which the inventor is aware, and is tendered with a view toward discharging the inventor's acknowledged duty of candor, which may be pertinent to the patentability of the present invention. It is respectfully stipulated, however, that the foregoing discussion does not teach or render obvious, singly or when considered in combination, the inventor's claimed invention.

SUMMARY OF THE INVENTION

[0015] The invention is a method for performing gastric bypass surgery and an inventive gastric bypass band used along with the method.

[0016] The method of surgery involves separating the esophagus and a portion of the proximal stomach from the top

of the remaining major portion of the stomach. The separated portion is used to form a small gastric pouch that can hold between 20-30 cc (about $\frac{1}{8}$ cup) of food material. The inventive gastric bypass band is then placed in the mid-portion of the pouch to create a valve-like opening which will cause solid foods to stay in the gastric pouch for awhile, to give the sensation of a "full stomach." The band also prevents stomal dilation, that is the stoma, or opening between the pouch and small intestine (described further below) is prevented from dilating.

[0017] Still in reference to the inventive method, the small intestine is bisected to create a top section and a bottom section. Preferably, the top section includes the duodenum which retains all of its capability to receive liver bile, enzymes, and pancreatic secretions. The bottom section is connected to the bottom of the gastric pouch so that any food materials that pass by the gastric band restriction will empty directly into the small intestine for further digestion. The top section is then connected to the bottom section of the intestine which allows liver bile and pancreatic secretions from the top section to come into contact with the partially digested food materials that have been traveling from the gastric pouch down to the bottom section. Liver bile begins fat digestion for the first time and as a result, fats are only partially absorbed, contributing to greater weight loss.

[0018] The majority portion of the stomach comprising the remaining stomach and duodenum is completely separated from the manufactured digestive tract consisting of the gastric pouch and bottom section of the small intestine. The majority portion is sewed against the inner body cavity wall of the patient, and a radiopaque marker band is placed between the majority portion and the body cavity wall. A gastrostomy tube is placed through the marker band for immediate post operative care and the radiopaque marker band functions as a marker to locate this stomach site if it becomes necessary to place a gastrostomy tube for decompression or to feed the patient normally through the stomach or else to allow the surgery to be reversed and the stomach reconnected at a later date. The inventive gastric bypass band is also radiopaque.

[0019] The gastric band device which also comprises the invention is comprised of an expansion-resistant section that is attached to a latching mechanism. Preferably, the latching mechanism is of a one-way, male-female design, which comes together from opposite ends of the expansion-resistant section. When the latch is engaged, the band device assumes a radial shape which encircles the gastric pouch at a location selected by the surgeon. The radial shape and small width of the band helps prevent the device from becoming ingrown into the gastric pouch and/or causing tissue necrosis. The radial shape is best achieved if the opposite components of the latch are curved to aid in forming the radial shape upon joining the ends of the latch together.

[0020] It has been found that over time, using experimental fore runners of the inventive device and method, when employed together, resulted in patients maintaining their weight loss in 90% of the cases that are followed beyond 5 years post-surgery. This, compared with a success rate of only 65% of weight loss beyond 5 years post-surgery for the prior art gastric bypass surgery methods and banding devices, illustrates a large advantage of the inventive device and method.

[0021] As such, the following objects and advantages are sought to be achieved by the inventive gastric bypass band device and medical method:

[0022] An object of the invention is to provide a gastric bypass surgical method which bypasses the majority of the stomach and duodenum, thereby resulting in less post-surgery expansion of the gastric pouch.

[0023] Another object of the invention is to provide a gastric bypass band device which is available in multiple sizings to be able to meet any surgical situation.

[0024] Still another object of the invention is to provide a medical method and associated gastric band device which results in maintaining a 90% weight loss, beyond 5 years post-surgery, in morbidly obese patients.

[0025] Another object of the invention is to provide a device that can be easily placed and removed less invasively, laparoscopically, thereby reducing surgical recovery time to around three weeks.

[0026] Further objects and advantages of the invention will be brought out in the following portions of the specification, wherein the detailed description is for the purpose of fully disclosing preferred embodiments of the invention, without placing limitations thereon.

BRIEF DESCRIPTION OF THE DRAWINGS

[0027] The invention will be more fully understood by reference to the following drawings which are for illustrative purposes only:

[0028] FIG. 1 is a frontal view of a human esophagus, stomach and partial small intestine to illustrate the body locations near the esophagus and small intestine where the inventive medical procedure is performed.

[0029] FIG. 2 is a frontal view of a human body cavity showing the esophagus connected to the lower portion of the small intestine and the upper portion of the small intestine, containing the duodenum, being connected to the lower portion of the small intestine.

[0030] FIG. 3 is an elevated perspective view of the inventive gastric bypass band shown in its engaged state.

[0031] FIG. 4 is a cross sectional view through the expansion resistant section of the inventive gastric bypass band.

[0032] FIG. 5A is a closeup elevated perspective view of the female portion of the latch.

[0033] FIG. 5B is a closeup elevated perspective view of the male portion of the latch.

[0034] FIG. 5C is a closeup elevated perspective view of the male portion of the latch fully engaged within the female portion.

[0035] FIG. 6 is a side view of the gastric bypass band device shown in an engaged position, illustrating the radial shape of the device.

[0036] FIG. 7A is a side view of a protective cover for engaging with the female portion of the gastric bypass band device.

[0037] FIG. 7B is a front elevated perspective view of the cover.

[0038] FIG. 8 is an elevated perspective view of the radiopaque marker band of the present invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0039] Referring to FIGS. 1 and 2, the preferred embodiment of the inventive medical method can be shown. The medical method is performed laparoscopically in 90% of the cases. In FIG. 1, the organs of the esophagus 10, stomach 14, duodenum 16, small intestine 18 and gall bladder 20 are

shown. The focus of the medical method is upon the modifications made to the esophagus **10**, stomach **14** and small intestine **18**. As first shown in FIG. 1, a gastric pouch is manufactured by preferably separating the esophagus **10** and part of the lesser curvature **22** of the stomach from the remainder of the stomach **14** at point A. The small intestine **18** is bisected at point B. The location of point B is preferred because it results in the duodenum **16** being completely bypassed along with the stomach **14**. Bypassing the duodenum results in selective fat malabsorption which results in more weight loss than in prior art gastric bypass methods. The duodenum remains fully functional and continues to receive liver bile from the hepatic ducts **24** and enzymes from the pancreatic duct **26**.

[0040] Referring now to FIG. 2, the formation of the gastric pouch and the re-connection of the small intestine can be described. The proximal stomach is bisected on the lesser curvature **22** just below the esophagus **10**, leaving a small stomach segment **28** that is connected to the proximal jejunum **18**, this esophageal and small stomach segment is what will eventually form the gastric pouch **30** having a size of between 20-30 cc. The bottom section of the small intestine (proximal jejunum) **18** below the duodenum **16** is connected to the small stomach segment **28** through a hand sewn closure to form an anastomosis (not shown) that is 1.5 to 2 cm wide. The anastomosis is impervious to air and water and allows direct entry of the contents of the gastric pouch **30** into the small intestine **18**, which causes the release of satiety stimulating chemicals known as enterokinins. This release of enterokinins is even induced by the obese individual's salivary secretions that go from the gastric pouch **30** to the small intestine **18**. This feeling of satiety, or "fullness" results in anorexia and enhances initial weight loss as well as the maintenance of weight loss over time.

[0041] Above the anastomosis and above the bottom of the pouch **30**, about 2 cm, is placed the inventive gastric bypass band device **32**. The gastric band device acts as a restrictor valve which controls the emptying of partially digested food materials from the gastric pouch **30**. The gastric band **32** is preferably placed at the distal portion of the gastric pouch **30**. When the inventive gastric band is in place, the portion of the pouch above the gastric band is 15 to 20 cc in capacity and the portion of the pouch below the band is about 8 to 10 cc in capacity. This compared to the normal 2000-3000 cc capacity of the stomach illustrates the restriction in food intake provided by the gastric pouch. Once the gastric pouch is full of food materials, a feeling of satiation is experienced, resulting in anorexia. The gastric band device **32** preferably ranges in size between 5.5-7.0 cm in inner circumference. In addition to its function as a restrictor valve, the gastric band **32** prevents stomach dilation, meaning that the restricted opening provided by the band never expands in size due to the expansion-resistant construction of the device. Moreover, the pouch **30** is more resistant to expansion than the stomach. The relative size of the pouch ensures that excessive expansion does not occur. Patients that have been X-rayed five years post-surgery show that the pouch has not expanded by much. Moreover, the small size of the pouch insures that if a patient over-eats, the food will back up into the esophagus, thereby causing the patient to regurgitate the food. This factor operates as a self-regulating feature, and for this reason, patients are counseled to keep their food intake to a minimum.

[0042] The duodenum **16** is re-joined to the small intestine **18** to form a Y-limb **34**, with one deviation of the limb going

upward to the duodenum and the other deviation proceeding upward to the gastric pouch **30**. The intestine-intestine connection **36** forms an anastomosis (not shown) of approximately 2 cm, that is wide enough to allow food to pass through easily. At the point of anastomosis, pancreatic juices and liver bile from the duodenum can now come into contact with the partially digested food that travels down the second section of the intestine from the pouch. Liver bile begins fat digestion for the first time, and as a result, fats are only partially absorbed, thereby helping contribute to weight loss. Sugars are absorbed, but discouraged as part of the patient's diet, because with the stomach disconnected, they go directly into the intestines, causing some patients to have "Dumping Syndrome." This is a very uncomfortable feeling of cramps, flushing, fast beating heart, weakness and sometimes watery stools.

[0043] The stomach **14**, although disconnected, remains fully functional, and if necessary can be reactivated by reversing the surgery and re-connecting the stomach segment **28** and small intestine **18** to their prior, natural, state. The stomach **14** can also be reactivated by placing a temporary gastrostomy tube **38**, as shown, through which food can be routed, should this be necessary. To facilitate the reactivation of the stomach **14**, the stomach opening **40** can be marked with a radiopaque marker band **42** or disk, that is sutured to the abdominal wall, thereby making it clearly visible to allow the surgeon to find the stomach entry site **40** on an X-ray, to allow easy reactivation.

[0044] The inventive gastric bypass band device **32** that was introduced previously, as being crucial to the successful result of the inventive surgical method, will now be described in terms of its preferred embodiment. Referring to FIG. 3, the gastric bypass band **32** is comprised of an expansion-resistant section **44** mated to a latch **46**, which locks upon full engagement, thereby preventing the device **32** from opening up while positioned within the body. The latch **46** is of a one-way variety and can only be released through the application of a specialized surgical tool (not shown). The expansion-resistant section **44** prevents the device from expanding too far, thereby restricting the amount of food traveling from the gastric pouch **30** to the small intestine **18**. It is important for the device to retain food within the pouch long enough for the patient to feel sated, thereby reducing hunger and preventing further eating. The expansion-resistant section **44** is preferably made from implant grade silicone rubber surrounding a monofilament core. The monofilament can be polypropylene suture material, which is resistant to expansion. The latch is preferably made from surgical-grade plastics such as polypropylene or acetal, which gives both strength and lubricity to the latch.

[0045] FIG. 4 shows a transverse cross section of the expansion-resistant section **44** which illustrates the monofilament core **48** surrounded by silicone material **50**. Alternatively, the silicone material can be a silicone tube having a monofilament core therein. The expansion-resistant section **44** preferably has a flat-faced inner side **52** as shown. This flat face **52** continues longitudinally along the length of the expansion-resistant section **44**. The flat face **52** forms a flat-sided inner circumference when the latch of the device is engaged, as shown in FIG. 3. It has been found that the flat face prevents the expansion-resistant section from migrating into the patient's tissue and prevents tissue erosion. Also crucial with regard to preventing leakage caused by the device eroding into the internal lumen of the gastric pouch is that the cross-

sectional diameter of the expansion-resistant section 44 is kept to 0.125", or less. If erosion occurs, it has been found that if the cross section is kept to these approximate dimensions the pouch tissue will form a scar around the band device 32, and in essence seal off the device, thereby preventing any leakage.

[0046] Erosion is caused by tissue necrosis, where tissue dies when the supply of blood to the area is cut off. Prior art larger, thicker, band devices, have been known to necrose when the food pouch begins to sag, making a deep sack out of which food has difficulty being passed. This food begins to decay in the pouch, which can lead to necrotic complications. The larger, thicker, prior art devices penetrate the necrosed area in time, creating a break in the gastric pouch, which can lead to leakage of the pouch contents into the interior of the body cavity. In the worst cases this can lead to death; in the minor cases, additional surgery is necessary to repair the breached pouch. Contrastingly, fewer pouch breaches are experienced with the present invention than with the prior art devices.

[0047] Referring now to FIGS. 5A, 5B and 5C the latch 46 can be examined. The latch is preferably a one-way latch employing a one-way male-female engagement. The opposite ends 54, 56 of the expansion-resistant section 44 are each mated to one-half of the male-female latch as shown in FIG. 3 and a preferred method of mating is further described below.

[0048] As shown in FIG. 5A, the female portion 58 of the latch 46 is illustrated in detail. The female portion has an exterior body 60 and an interior lumen 62 for receiving the male portion 64 of the latch. The lumen 62 is sized to compress the lateral prongs 66 of the male portion 64. Under surgical conditions, engagement of the male and female portions is performed with a forceps, laparoscopically. The preferred interior lumen 62 dimensions are approximately height=0.082"×width=0.190×length=0.300". A pair of openings 68 are placed in each side 70 of the female portion 58 to allow for the expansion of the lateral catches 72 of the male portion 64. The lateral catches 72 engage fully and laterally within the side openings 68, in a one-way fashion. Side openings 68 have top, bottom, rear and front walls, which engage catches 72. The engagement is such that the latch can be released only after applying a special surgical tool (not shown) to disengage the latch 46, by placing inward force upon catches 72 through side openings 68. The lumen 62 opens outward and the face 74 of the opening of the lumen is inwardly beveled so as to receive the outward bevels 76 of the male portion 64. The corner facings 78 of the female portion 58 are rounded so as to present a non-irritating surface to the patient.

[0049] Still referring to FIG. 5A, the body 60 of the female portion 58 is longitudinally curved 80. The curvature of the female portion 58 mates with the longitudinally curved male portion 64 to form the device 32 into a radial shape as shown in FIG. 6. This radial shape is crucial for preventing the device from becoming ingrown within a patient's tissue, as this shape applies equal pressure to the enclosed tissue at every point along the inside circumference of the device 32. Shapes that are non-circular (e.g. oblong shapes) tend to apply unequal pressure along their inside circumference, thereby resulting in a cutoff of blood supply, necrosis, and eventual tissue erosion and leakage as discussed previously. For each graduation in inner circumference of the inventive device 32, a corresponding radius of curvature applies which contributes to the forming of the proper radial shape in each case. The

radii of curvature in inches is listed after each graduation in inner circumference (centimeters) as follows: 5.5 cm=0.398"; 6.0 cm=0.422"; 6.5 cm=0.460" and 7.0 cm=0.492". Also, for the same graduations, the following diameters apply: 5.5 cm=1.75 cm dia; 6.0 cm=1.91 cm dia; 6.5 cm=2.07 cm dia; 7.0 cm=2.23 cm dia. The inner circumference that is used is open to the discretion of the surgeon, but generally, men require 6.5 and 7.0 cm sizes while women require 5.5 and 6.0 cm devices.

[0050] Referring now to FIG. 5B, the male portion of the latch is shown as comprising a pair of lateral prongs 66, the prongs being longitudinally curved to mate efficiently within the lumen 62 of the female portion 58. Preferably, prongs 66 are approximately 0.076" thick, by 0.040" wide. The prongs terminate at their front with lateral catches 72 which are molded integrally with the prongs 66. Lateral catches 72 are angled longitudinally along their side face 84, the angled attitude allowing easy entry of the prongs 66 into the lumen 62 of the female portion 58, which is an important feature under surgical conditions. Side faces 84 having steeper angles give a mechanical advantage when locking. The preferred angle of side faces is 36 degrees or less. The catches 72 further comprise lateral catch faces 86, which engage the front walls of the side openings 68 of the female portion 58. When the catches 72 of prongs engage, it is preferred that they remain engaged under a pulling stress of at least 5 pounds of force. The prongs 66 are separated by inner space 88, which allows the prongs to travel inward and outward. The prongs 66 terminate rearwardly at prong body 90, which provides a base of structural integrity from which prongs can confidently travel inward and outward as they engage the interior walls of lumen. Prong body 90 migrates further rearward to become outwardly beveled face 76 which mates with inwardly beveled face 74 of the female portion 58. The beveled face 76 migrates further rearward to become hilt 92. Hilt 92 is where the front opening of the female portion 58 fully engages against. This engagement is shown in FIG. 5C which illustrates lateral catches 72 seated in the side openings 68 of female portion 58, the hilt being 92 engaged with the front opening of female portion. The circumference of the body 60 of female portion 58 and the circumference of the hilt 92 of the male portion 64 are preferably identical so as to provide a fairly uninterrupted surface traveling from one to the other.

[0051] Also shown in FIGS. 5A and 5B are anchor arms 94, which are used to attach the male and female portions of latch to the expansion-resistant section 44. Anchor arms 94 retain the curved theme of the male and female portions, 58, 64 of the latch 46. Anchor arms 94 are molded integrally with their corresponding latch portion and curve rearwardly so as to retain the radii of curvature of the inventive device noted previously. The expansion-resistant section which is comprised of surgical grade silicone and monofilament is attached to the anchor arms as follows. Referring again to FIG. 5B, the front opening 96 of lumen 98 is shown, and its rearward path of travel through anchor arm is shown in phantom. A similar arrangement exists for female portion. Monofilament 48 enters the rear of anchor arm and is fed through lumen until it protrudes through the front opening of lumen. The monofilament 48 is then tied off in a manner so as to anchor it in place along with the silicone material as seen in phantom, in FIG. 3.

[0052] As FIGS. 7A-7B show, the body 60 of female portion 58 may also be fitted with a disposable cover 100 so as to reduce its potential to snag upon tissue as it is being fed through and positioned around the gastric pouch 30 during

laparoscopic surgery. As the device is fed through the tissue and around the new pouch, it is led by the female portion **58**. Cover **100** provides a streamlined shape which can be grasped by a forceps and easily led through the tissue. FIG. 7A is a side view showing the female end **58** positioned in the cover **100**, with the remainder of the device trailing out the back end **102** of cover **100**. Back end **102** of cover includes a lumen (see FIG. 7B) **104** for receiving female end **58**, the lumen being sized to snugly grasp female end without coming loose during surgical placement. The sides of lumen are preferably ringed with small ridges **106** to reduce the frictional engagement between female portion **58** and the cover **100** to a level that allows easy removal of the cover once the device is in place. As seen in FIG. 7B, cover **100** further comprises a blunt front end **108** which extends into an elongate portion **110**. The blunt front end **108** facilitates easy movement through tissue. The elongate portion **110** is for grasping by the surgeon's forceps to allow the cover to be threaded through tissue. Past the elongate portion **110**, the cover **100** has a gently tapered region **112**, which, again contributes to easy movement through tissue. At its widest point, the cover is about 0.250 to allow easy movement through a trocar during laparoscopic surgery. The cover is preferably made from a radiopaque material for easy sighting on an X-ray. The cover is removed and discarded once the device has been positioned around the gastric pouch.

[0053] Referring now to FIG. 8, the radiopaque marker band **42** previously shown in FIG. 2 can be more precisely described. The band's inside diameter is approximately 0.8" and the outside diameter is approximately 1" with a thickness of approximately 0.06". The band is preferably flat along its major surfaces **114**, **116**. The marker band **42** can be made from polyester mesh that is coated with surgical grade silicone. Also, it is envisioned by the inventor that the inventive device **32** can be combined with the radiopaque marker band **42** shown in FIG. 8, as well as with the disposable cover **100** to form a surgical kit. This kit can then be installed surgically using the method previously described.

[0054] Finally, although the description above contains many specificities, these should not be construed as limiting the scope of the invention but as merely providing illustrations of some of the presently preferred embodiments of this invention. Other modifications by those skilled in this art are possible and are included within the scope of the appended claims.

What is claimed is:

1. A surgical band device that is laparoscopically implantable within a patient's body, comprising:
 - a flexible expansion-resistant section having first and second ends, the expansion-resistant section having a flat face extending along its length between the first and second ends, the expansion-resistant section being of uniform-cross section between the first and second ends; and
 - a lockable latch having a longitudinal curvature and first and second latch parts coupled to the first and second ends of the expansion-resistant section; wherein the expansion-resistant section having a longitudinally extending configuration along its length when the first and second latch parts are unlocked and the surgical band device is fed laparoscopically through tissue within the patient's body and a radial shape configura-

tion along its length when the first and second latch parts are locked and the surgical band device is positioned around tissue within the patient's body;

wherein the first and second latch parts of said lockable latch are engaged by a male-female type engagement; wherein the first latch part of the lockable latch including an exterior body having an interior lumen, said exterior body having side through-openings communicating with said lumen, said lumen including a front opening; wherein the second latch part of the lockable latch including prongs extending from a prong body, said prongs extending forward of said prong body and having two lateral catches, said lateral catches including angled side faces for engaging in a lockable one-way engagement with said side openings of said second latch part when said first and second latch parts are fully engaged.

2. The band device as recited in claim 1, wherein the expansion-resistant section comprises a length of silicone having a monofilament core.

3. The band device as recited in claim 2, wherein the monofilament core is a polypropylene suture.

4. The band device as recited in claim 3, wherein the device is radiopaque.

5. The band device as recited in claim 1, wherein the latch locks in a one-way engagement.

6. A surgical kit, comprising:

a gastric bypass band device that is laparoscopically implantable within a patient's body, comprising:

a flexible expansion-resistant section having first and second ends, the expansion-resistant section having a flat face extending along its length between the first and second ends, the expansion-resistant section being of uniform-cross section between the first and second ends; and

a longitudinal curved lockable latch having first and second latch parts coupled to the first and second ends of the expansion-resistant section; and wherein the expansion-resistant section having a longitudinally extending configuration along its length when the first and second latch parts are unlocked and the surgical band device is fed laparoscopically through tissue within the patient's body and a radial shape configuration along its length when the first and second latch parts are locked and the surgical band device is positioned around tissue within the patient's body;

a radiopaque marker band; and

a disposable positioner cover fitted over the second latch part and having a blunt forward profile for guiding the gastric band device into position about tissue in a patient's body.

7. The surgical kit as recited in claim 6, wherein the band device, and the disposable cover are radiopaque.

8. The surgical kit as recited in claim 6, wherein the positioner cover further comprises a lumen for receiving the second latch part, the lumen of the positioner cover being lined with longitudinal ridges.

9. The cover as recited in claim 8, wherein the lumen forms a rear opening in the positioner cover, the lumen portion extending forward and mating with an elongate portion of the positioner cover, the elongate portion terminating in a blunt forward end.

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摘要(译)

纳米增强装置技术领域本发明涉及一种用于在装置和组织之间物质转移的纳米增强装置。该装置包括基底，该基底具有固定在基底内的基本上对齐的碳纳米管，并且碳纳米管的至少一端从基底突出。突出的纳米管末端可涂覆有药物，用于将药物递送到身体组织中。本发明可以结合到血管成形术导管球囊中或者佩戴在皮肤上的贴片中。碳纳米管可以成簇分组以有效地形成纳米针，其可以将流体输送到皮下组织或从皮下组织输送流体。纳米针可与传感器结合使用，以确定体液信息，如pH，葡萄糖水平等。

