

A CONNECTOR AND A DEVICE FOR ANASTOMOSIS

Technical Field

The present invention relates to anastomosis of a living tissue, and more particularly to
5 a connector for connecting two anastomotic devices as well as to devices for
arrangement on the sidewall of an intestine or on an end part of an intestine and to a
device for anastomosis of a tubular structure.

Furthermore, the invention relates to a method for mounting such a device to a
tubular structure.

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Background

Colorectal cancer is the third most frequent type of cancer in the world having an
occurrence of about 1 million new cases every year. The incidents of cancer are
considerably more frequent in the industrial part of the world.

15 Current techniques for mechanically performing anastomosis of hollow organs
use circular mechanical staplers, which execute the connection of the tissue edges of the
dissected hollow organ by metallic or plastic staples. A wide variety of surgical staplers
have been developed for gastric, oesophageal and intestinal surgery. In performing
surgical anastomotic stapling, generally two pieces of the hollow organ are joined by a
20 ring of staples with a closed loop stapler. End to end anastomoses are generally
performed by intraluminal surgical staplers that deliver a pair of staggered rings of
staples. During this process, a circular knife blade is used to separate the tissue that is
held within the circular ring. The separated tissue is then removed with the stapler to
form a circular opening within the lumen along the stapling line.

25 A major issue regarding anastomosis healing is the blood circulation of the
anastomosis during the healing process. Despite substantial development of surgical
techniques during the last decades, morbidity and mortality after resections in the
gastrointestinal tract, e.g. due to anastomotic leakage, remain as serious problems.
Ischemia and inflammation, which are natural parts of the healing process, may cause
30 leakage and secondary infection in the stapling area, which may be fatal for the patient.
Therefore, it has become common practice to relieve the pressure from the anastomosis

by performing a deviating stoma, especially when the anastomosis is carried out in the lower part of colon and in rectum. By relieving pressure and faecal stream from the anastomosis during the healing process, the leakage incident may be reduced and fatal consequences of anastomotic dehiscence can be avoided. The inconvenience for the patient is obvious, since the patient must have a temporary stoma for a time period of about 3 to 6 months, and then has to undergo a second surgery in order to close the stoma. Unfortunately, in many cases, the closure of the stoma cannot be reversed and the patient is forced to live with a permanent stoma leading to lower quality of life associated with increased costs.

10 Additionally, there is an increased risk of anastomotic stenosis, when surgical staplers create a smaller and more rigid opening compared to the cross section of the original lumen due to the staples inside the hollow structure connecting the two ends thereof, i.e. a collar may be formed that may lead to stenosis.

 Hence, there has been a need in the technical field to develop assemblies overcoming these disadvantages. Such assemblies are disclosed in WO 2007122223 and WO 2014031065, wherein assemblies comprising interlocking members for use in achieving anastomosis of tubular organs are disclosed. The assemblies comprise two rigid parts, onto which two elastic rings are arranged, to secure intestine ends, respectively, in between each rigid part and corresponding elastic part, where after the rigid parts are interconnected via a connection member. It is however difficult to use such open end anastomotic rings for connecting the side of an intestine to another side or an open end, which is often called for due to tumors with difficult access.

Summary

25 Accordingly, the present invention preferably seeks to mitigate, alleviate or eliminate one or more of the above-identified deficiencies in the art and disadvantages singly or in any combination and solves at least the above mentioned problems by providing a connector for connecting two anastomotic devices, said connector comprising a tubular part having a generally hollow open configuration, and being arranged centrally on an axis of the connector; a first end part extending in a first direction axially from the tubular part, wherein said first end part comprises at least one continuous or

discontinuous circumferential flange extending radially outwards from the first end part, and/or at least one continuous or discontinuous circumferential groove, extending radially inwards from the first end part; and a second end part extending in a second direction axially from the tubular part.

5 Such connector provides for a versatile connection at difficult intestinal areas.

 The connector may comprise one single piece. Preferably, the connector comprises at least two pieces, or more preferably at least three pieces. A connector comprising separate pieces facilitates obtaining a void between the flange and the tubular part in the central-lateral direction, i.e. along a transversal plane in relation to
10 the axial extension of the tubular part, since the pieces then can be injection molded. After manufacture of the separate pieces, the pieces are assembled to the connector.

 A device for arrangement on the sidewall of an intestine or on an end part of an intestine is also provided, said device comprising a first member and a second member, wherein the first member comprises an elastic part with a first and a second axial end,
15 and a rigid support arranged at the first axial end of the elastic part; wherein the second member comprises a first and a second axial end, said first end of the second member matching the shape of the second axial end of the elastic part, such that an intestine wall may be uniformly distributed between the second axial end of the elastic part and the second member; and at least one connection member for connecting the rigid support
20 part and the second member to each other, wherein said at least one connection member comprises pin receiving means; and wherein the second member comprises at least one circumferential groove, arranged on an inside surface of the second member located radially inwards, and/or at least one groove, arranged on an inside surface of the second member located radially outwards, for interaction in a locking manner with at least one
25 flange on a connector according to the present disclosure.

 A device for anastomosis of a tubular structure is also provided, said device comprising a connector according to the present disclosure, a device or arrangement on the sidewall of an intestine or on an end part of an intestine as disclosed above and at least one pin.

30 A device for arrangement on the sidewall of an intestine or on an end part of an intestine is also provided, said device comprising a member, wherein the member

comprises an elastic part with a first and a second axial end, and a rigid support arranged at the second axial end of the elastic part, said first axial end of the elastic part matching the shape of the radial protrusion of a connector according to the present disclosure, such that an intestine wall may be uniformly distributed between the first
5 axial end of the elastic part and the radial protrusion of the connector, wherein said second end further comprises at least one connection member, wherein said at least one connection member comprises pin receiving means.

A device for anastomosis of a tubular structure is also provide, the device comprising a connector according to the present disclosure and a device for arrangement
10 on the sidewall of an intestine or on an end part of an intestine according to the present disclosure.

A method for mounting a device for anastomosis of a tubular structure according to the present disclosure to a tubular structure having a first end and a second end that are to be connected is also provided, the method comprising the steps of arranging a
15 first device at the first end of the tubular structure, wherein the first device is a device for arrangement on the sidewall of an intestine or on an end part of an intestine according to the present disclosure; connecting a connector according to the present disclosure and the first device; arranging a second device at the second end of the tubular structure, wherein the second device is a device according to the present
20 disclosure; connecting the connector and the second device. Optionally, the catheter may enter into the lumen of the tubular structure through the first device.

Further objects, features and advantages of the present invention will appear from the following detailed description, from the attached drawings as well as from the dependent claims.

25 In the claims, the term “comprises/comprising” does not exclude the presence of other elements or steps. Furthermore, although individually listed, a plurality of means, elements or method steps may be implemented. Additionally, although individual features may be included in different embodiments, these may possibly be combined in other ways, and the inclusion in different embodiments does not imply that a
30 combination of features is not feasible. In addition, singular references do not exclude a plurality. The terms “a”, “an” does not preclude a plurality. Reference signs in the

claims are provided merely as a clarifying example and shall not be construed as limiting the scope of the claims in any way.

Brief Description of the Drawings

5 These and other aspects, features and advantages of which the invention is capable of will be apparent and elucidated from the following description of embodiments of the present invention, reference being made to the accompanying drawings, in which

Fig. 1a is a perspective view of a connector according to one embodiment of the present disclosure.

10 Fig. 1b is a cross sectional view of a connector according to one embodiment of the present disclosure.

Fig. 1c is a cross sectional view of a connector according to one embodiment of the present disclosure.

15 Fig. 1d is a cross sectional view of a connector according to one embodiment of the present disclosure.

Fig. 2a is a perspective view of a connector according to one embodiment of the present disclosure.

Fig. 2b is a cross sectional view of a connector according to one embodiment of the present disclosure.

20 Fig. 3a is a perspective view of a connector according to one embodiment of the present disclosure.

Fig. 3b is cross sectional view of a connector according to one embodiment of the present disclosure.

25 Fig. 3c is cross sectional view of a connector according to one embodiment of the present disclosure.

Fig. 4 is a perspective view of a connector according to one embodiment of the present disclosure.

Fig. 5a is a cross sectional view of a connector according to one embodiment of the present disclosure.

30 Fig. 5b is a cross sectional view of a connector according to one embodiment of the present disclosure.

Fig. 6a is a cross sectional and exploded view of a device according to one embodiment of the present disclosure.

Fig. 6b is a cross sectional view of a second member of a device according to one embodiment of the present disclosure.

5 Fig. 6c is a cross sectional view of a connector according to one embodiment of the present disclosure interacting in a locking manner with a second member of a device according to one embodiment of the present disclosure.

Fig. 7 is a cross sectional view of a device for anastomosis according to one embodiment of the present disclosure mounted in a tubular structure.

10 Fig. 8a is a cross sectional and exploded view of a device according to one embodiment of the present disclosure. Fig. 8b is a cross sectional and exploded view of a connector according to one embodiment of the present disclosure and a device according to one embodiment of the present disclosure.

15 Fig. 9 is a cross sectional view of a device for anastomosis according to one embodiment of the present disclosure mounted in a tubular structure.

Detailed Description

Several embodiments of the invention are described below with reference to the drawings in order to enable a skilled person to perform the invention. However, the features and method steps included in these embodiments do not limit the invention. Moreover, the features and method steps may be combined in other manners than specifically described.

In Figs. 1 to 5, different embodiments of a connector for connecting two anastomotic devices are shown.

25 When creating an anastomosis between two ends of a tubular structure, such as an intestine, a device 200, 300 for arrangement on the sidewall of an intestine or on an end part of an intestine is arranged at each end. The two devices 200, 300 for arrangement on the sidewall of an intestine or on an end part of an intestine are connected by a connector 100. The two devices used at the two ends of the tubular structure that are to be connected may be the same kind of device 200 (see Fig. 7). In such a case, the connector 100 is symmetrical or essentially symmetrical, e.g. as shown

in Figs. 2 and 3. The two devices used at the two ends of the tubular structure that are to be connected may be two different devices 200, 300 (see Fig. 9). In such a case, the connector 100 is asymmetrical, e.g. as shown in Figs. 4 and 5.

When creating an anastomosis between two ends of a tubular structure, the two ends are the remaining ends of an intestine where a part between the ends has been removed. The ends may be joined opening to opening, side to side, or side to opening.

Figs. 1a to 1d show a connector 100 according to the present disclosure. The connector 100 has a generally hollow open configuration when arranged on the sidewall of an intestine or on an end part of an intestine.

The connector 100 may be of a polymeric material, more specifically a biocompatible material and most specifically a biodegradable material.

The connector 100 may comprise one single piece.

Preferably, the connector 100 comprises at least two pieces, or more preferably at least three pieces, as shown in Figs. 1c, 3c, 5b, 6a, and 6b. A connector 100 comprising separate pieces facilitates obtaining the void 112. After manufacture of the separate pieces, the pieces are assembled to the connector 100.

The connector comprises a tubular part 101 having a generally hollow open configuration and being arranged centrally on an axis of the connector 100.

A first end part 102 extends in a first direction axially from the tubular part 101.

The first end part 102 comprises at least one circumferential flange 106, extending radially outwards from the said first end part 102. The flange 106 may be continuous or discontinuous, i.e. it may be one homogenous flange extending radially around the tubular part 101 or it may comprise flange segments aligned radially around the tubular part 101. Preferably, the flange 106 is flexible, which facilitates the connection of the connector 100 to a device 200, 200', 300 for arrangement on the sidewall of an intestine or on an end part of an intestine. The blow up in Fig. 1b shows details of a preferred variant of the flange 106, wherein a space or void 112 is located centrally/laterally under the flange 106. This makes the flange 106 flexible.

A preferred embodiment of the flange 106 is shown in Fig. 1c. In this embodiment, the connector 100 comprises at least two pieces, the main body A, and a flange body B. Together, the two pieces form the flange 106 and the space or void 112.

The space or void 112 is located in a central-lateral direction between the central part 101 and the first end part 102 under the flange 106. This renders the flange 106 flexible, which facilitates the connection of the connector 100 which facilitates the connection of the connector 100 to a device 200, 200', 300 for arrangement on the sidewall of an intestine or on an end part of an intestine. Furthermore, as described above, a connector 100 comprising separate pieces is easy to manufacture. After manufacture of the separate pieces, the pieces are assembled to the connector 100.

The number of flanges 106 may vary between one and five. Preferably, there are three flanges 106. The flanges 106 are for engagement with grooves arranged on the inside of a device for arrangement on the sidewall of an intestine or on an end part of an intestine. In this way, the connector and the device for arrangement on the sidewall of an intestine or on an end part of an intestine are engaged in a locking manner. Alternatively, or additionally to the at least one circumferential flange 106, the first end part 102 may comprise at least one circumferential groove 106', extending radially inwards from the first end part 102. The groove 106' may be continuous or discontinuous, i.e. it may be one homogenous groove extending radially around the tubular part 101 or it may comprise groove segments, such as notches, aligned radially around the tubular part 101. The number of grooves 106' may vary between one and five. Preferably, there is one groove 106'. The groove 106' is for engagement with a flange arranged on the inside of a device for arrangement on the sidewall of an intestine or on an end part of an intestine. In this way, the connector and the device for arrangement on the sidewall of an intestine or on an end part of an intestine are engaged in a locking manner.

For simplicity, a connector 100 wherein the first end part 102 comprises at least one circumferential flange 106 (shown in Fig. 1b) is described in detail herein. However, the features described are equally relevant for a connector wherein the first end part 102 comprises at least one circumferential groove 106' (shown in Fig. 1d).

A second end part 103 extends in a second direction axially from the tubular part 101. The second end part 103 is preferably provided with means for engaging with a second device for arrangement on the sidewall of an intestine. These means may be flanges 106 and/or pin receiving means 109. The pin receiving means 109 may be a

track, optionally comprising an internal flange, or individual holes, slots or slits, optionally comprising an internal flange. In the embodiments shown in Figs. 5a and 5b, the connection member comprises pin receiving means 109. Preferably, the pin receiving means 109 comprise flanges at its mouth.

5 The number of pin receiving means 109 may vary between 18 and 30.

Preferably, there are between 20 and 26, such as 20, 22 or 24, pin receiving means 109.

The connector may have a circumferential recess 108 around its outer diameter to accommodate a sealing (see Fig. 2a). Thus, the first and/or the second end part may
10 comprise at least one circumferential recess 108 on the outer surface of said first and/or second end part, for accommodating a circular sealing member (see Fig. 2b).

The tubular part 101 may be provided with at least one through hole 104 for connection to a catheter 105. The number of through holes and corresponding catheters may vary between one and five. Preferably, there are four through holes, each through
15 hole connected to one catheter. The through holes 104 and catheters 105 can be arranged symmetrically or unsymmetrically around the periphery of the tubular part 101. The catheters 105 exit the connector through said first end part 102 or said second end part 103.

The catheters 105 have a length allowing for following the intestine out through
20 the anus of the patient, such that air or water may be pushed through the catheters to check the sealing pressure of the anastomosis.

A connector 100 according to the present disclosure may be used to connect two identical devices 200 (as shown in Fig. 7) or to connect two different devices 200, 300 (as shown in Fig. 9).

25 In one embodiment, shown in Fig. 3a, the second end part 103 comprises a circumferential flange 107, extending radially outwards from the said second end part 103. Preferably, the flange 107 is flexible, which facilitates the connection of the connector 100 to a device 200, 300 for arrangement on the sidewall of an intestine or on an end part of an intestine. A preferred variant of the flange 107 has the same or similar
30 configuration as shown for a variant of the flange 106 in the blow ups in Figs. 1b and 1c, wherein a space or void 112 is located centrally/laterally under the flange. This

makes the flange flexible. The number of flanges 107 may vary between one and five. Preferably, there are three flanges 107. The flanges 107 are for engagement with grooves arranged on the inside of a device for arrangement on the sidewall of an intestine or on an end part of an intestine. In this way, the connector and the device for arrangement on the sidewall of an intestine or on an end part of an intestine are engaged in a locking manner. Such a connector is preferably used when the anastomosis is located in the small or large intestine. The second part 103 may further comprise a second circumferential recess 108 around its outer diameter to accommodate a second sealing. Alternatively, or additionally to the at least one circumferential flange 107, the second end part 103 may comprise at least one circumferential groove 107' (not shown), extending radially inwards from the second end part 103. The number of grooves 107' may vary between one and five. Preferably, there is one groove 107'. The groove 107' is for engagement with a flange arranged on the inside of a device for arrangement on the sidewall of an intestine or on an end part of an intestine. In this way, the connector and the device for arrangement on the sidewall of an intestine or on an end part of an intestine are engaged in a locking manner.

For simplicity, a connector 100 wherein the second end part 103 comprises at least one circumferential flange 107 (shown in Fig. 1b) is described in detail herein. However, the features described are equally relevant for a connector wherein the second end part 103 comprises at least one circumferential groove 107'. Fig. 3b shows a connector according to one embodiment of the present disclosure. In this embodiment, a space or void 112 is located centrally/laterally under the flanges 106, 107.

Fig. 3c shows a connector according to one embodiment of the present disclosure. In this embodiment, the connector 100 comprises three pieces, the main body A, and two flange bodies B, B'. As described above, a connector 100 comprising separate pieces is easy to manufacture. After manufacture of the separate pieces, the pieces are assembled to the connector 100.

The connectors 100 shown in Figs. 3a to 3c may be used to connect two identical devices 200 (see Fig. 7).

The present disclosure also relates to a device 200 for arrangement on the sidewall of an intestine or on an end part of an intestine. One such device 200 is shown in Figs.

6a. The device 200 comprises a first member 210 and a second member 220. The first member 210 comprises an elastic part 211 with a first and a second axial end, and a rigid support 212 arranged at the first axial end of the elastic part 211. The second member 220 comprises a first and a second axial end, said first end of the second member 220 matching the shape of the second axial end of the elastic part 211, such that an intestine wall may be uniformly distributed between the second axial end of the elastic part 211 and the second member 220. The device 200 further comprises at least one connection member for connecting the rigid support part 212 and the second member 220 to each other, wherein said at least one connection member comprises pin receiving means 209. The pin receiving means 209 may be a track or individual holes, slots or slits, optionally comprising an internal flange. The second member 220 comprises at least one circumferential groove 240, arranged on a surface of the second member 220 located radially inwards, for interaction in a locking manner with at least one flange 106 on a connector 100 as described above. In one embodiment, the second member 220 comprises two circumferential grooves 240. Alternatively, or additionally to the at least one circumferential groove 240, the second member 220' comprises at least one circumferential flange 240' (shown in Fig. 6b), arranged on a surface of the second member 220' located radially inwards, for interaction in a locking manner with at least one groove 106' on a connector 100 as described above (shown in Fig. 6c).

For simplicity, a device 200 comprising a second member 220 having a circumferential groove 240 is described in detail herein. However, the features described are equally relevant for a device 200 comprising a second member 220' having a circumferential flange 240' (shown in Fig. 6b) interacting with a connector 100 having at least one circumferential groove 106' (shown in Fig. 1d).

The device 200 can be connected to an identical device 200 or to another type of device 300 (described below) via a connector 100 according to the present disclosure.

As shown in Fig. 6a, the device 200 for arrangement on the sidewall of an intestine or on an end part of an intestine comprises a first member 210 and a second member 220. The first member 210 and the second member 220 are both of a generally hollow open configuration when arranged on the sidewall of an intestine or on an end part of an intestine.

The first member 210 comprises an elastic part 211 and a rigid support part 212, shown in Fig. 6a.

The elastic part 211 is a substantial circular symmetric ring and is made as a compact body or as a tube, which may be filled with air, gas or fluid, and is made of an elastic polymeric material of for example 40 to 70 Shore. The elastic part 211 may for example be an elastic ring of a suitable polymeric or rubber material, such as an elastomer. The elastic part 211 may be biocompatible and/or biodegradable. The elastic part 211 may have a ring shaped cross-section. The elastic part 211 has a first and a second axial end. The cross section of the elastic parts 211 is shown as substantially circular. However, other shapes are possible, such as rectangular, triangular, hexagonal, octagonal etc.

The elastic part 211 can be only partially elastic. The elasticity is used for squeezing the tubular structure, e.g. an intestine I, between the elastic part 211 and the rigid support part 212, respectively, with a certain force. Other means performing the same function is possible to use.

The elastic part 211 may be attached to the rigid support part 212 through glueing or through over-moulding or co-moulding.

The rigid support part 212 may be of a polymeric material, more specifically a biocompatible material and most specifically a biodegradable material, of a rigidity adequate to stabilize the elastic part 211. The rigid support part 212 is arranged at the first axial end of the elastic part 211. The rigid support part 212 is also ring shaped, with one side thereof adapted to receive the elastic part 211. This side of the rigid support part 212 may then have an elastic part seat 213. The elastic part seat 213 may be concavely shaped to receive the convex axial end of the elastic part 211. Thus, the outer surface of the rigid part 212 comprises a recess intended to receive the elastic part 211. The recess has a shape that is at least partly complementary to the shape of the elastic part 211. Thus, the recess may be rectangular, triangular, hexagonal, octagonal, etc.

The second member 220 is provided with means for engaging with a connector 100 according to the present disclosure. These means may be a circumferential groove 240 and/or pin receiving means 209 (see Fig. 6a).

To create an anastomosis, two devices 200 for arrangement on the sidewall of an intestine on the sidewall of an intestine or on an end part of an intestine are connected to each other. The two devices 200, 200' may be connected by means of a connector 100 according to the present disclosure (shown in Fig. 7). Thus, the second member 220
5 comprises connection means for connection to the connector 100. The connection means may be at least one circumferential groove 240, arranged on a surface of the second member 220 located radially inwards. The grooves 240 of the two devices 200, 200' interact with the circumferential flanges 106 of the connector 100 in a locking manner. Alternatively, or additionally, the connection member is a pin 230 for
10 interaction in a locking manner with at pin receiving means 109 on the connector 100. The pins 230 are preferably of a biocompatible metallic material, but rigid polymers are also envisioned.

In another embodiment of the connector 100, shown in Fig. 4, the second end part 103 of the connector 100 comprises a radial protrusion 110 adapted to be in contact
15 with the intestine wall as shown in Fig. 9. The connector 100 shown in Fig. 4 may be used to connect two different devices 200, 300 (see Fig. 9).

Preferably, the flange 106 is a flexible flange.

Even more preferred, the flange 106 is a flexible flange as shown in the blow up of Fig. 1c, i.e. the connector 100 comprises at least two pieces, the main body A, and a
20 flange body B. Together, the two pieces form the flange 106 and the space or void 112. The space or void 112 is located in a central-lateral direction between the central part 101 and the first end part 102 under the flange 106. As described above, a connector 100 comprising separate pieces is easy to manufacture. After manufacture of the separate pieces, the pieces are assembled to the connector 100.

25 The radial protrusion 110 may be an integral part of the second end part 103 of the connector 100 (shown in Fig. 5a)). Alternatively, the radial protrusion 110 may be a separate part attached to the second end part 103 of the connector 100 (as shown in Fig. 5b).

30 In a specific embodiment, the connector comprises three separate parts; a main body A, a flange body B as shown in the blow up of Fig. 1c and a separate part attached to the second end part 103 of the connector 100 (as shown in Fig. 5b).

The radial protrusion 110 of the connector 100 is ring shaped, with one side thereof adapted to receive the elastic part 311 of a device 300 as disclosed in detail below. This side of the radial protrusion 110 of the connector 100 may then have an elastic part seat 113. The elastic part seat 113 may be concavely shaped to receive the convex axial end of the elastic part 311 of a device 300. Thus, the outer surface of the radial protrusion 110 of the connector 100 comprises a recess intended to receive the elastic part 311 of a device 300. The recess has a shape that is at least partly complementary to the shape of the elastic part 311 of a device 300. Thus, the recess may be rectangular, triangular, hexagonal, octagonal, etc.

10 The connector 100 may further comprise a partially closed membrane 111 at said second end part. This membrane provides stability when the device is arranged on the sidewall of an intestine or on an end part of an intestine.

Preferably, the second end part 103 comprises at least one connection member, preferably wherein said at least one connection member comprises pin receiving means 15 109. The pin receiving means 109 may be a track, optionally comprising an internal flange, or individual holes, slots or slits, optionally comprising an internal flange. In the embodiments shown in Figs. 5a and 5b, the connection member comprises pin receiving means 109. Preferably, the pin receiving means 109 comprise flanges at its mouth.

The number of pin receiving means 109 may vary between 18 and 30.

20 Preferably, there are between 20 and 26, such as 20, 22 or 24, pin receiving means 109.

The connector 100 shown in Figs. 4 and 5 may be used to connect two different devices 200, 300 (see Fig. 9).

Thus, present disclosure also relates to a device 300 for arrangement on the 25 sidewall of an intestine or on an end part of an intestine I (see Figs. 8a, 8b and 9). The device 300 comprises a member 310, wherein the member 310 comprises an elastic part 311 with a first and a second axial end, and a rigid support part 312 arranged at the second axial end of the elastic part 311. The first axial end of the elastic part 311 matches the shape of the radial protrusion 110 of an asymmetrical connector 100 according to the present disclosure, such that an intestine wall I may be uniformly 30 distributed between the first axial end of the elastic part 311 and the radial protrusion

110 of the connector 100. The elastic part 311 is a substantial circular symmetric ring and is made as a compact body or as a tube, which may be filled with air, gas or fluid, and is made of an elastic polymeric material of for example 40 to 70 Shore. The elastic part 311 may for example be an elastic ring of a suitable polymeric or rubber material, such as an elastomer. The elastic part 311 may be biocompatible and/or biodegradable. The elastic part 311 may have a ring shaped cross-section. The elastic part 311 has a first and a second axial end. The cross section of the elastic parts 311 is shown as substantially circular. However, other shapes are possible, such as rectangular, triangular, hexagonal, octagonal etc.

10 The elastic part 311 can be only partially elastic. The elasticity is used for squeezing the tubular structure, e.g. an intestine I, between the elastic part 311 and the radial protrusion 110 of the connector 100, respectively, with a certain force. Other means performing the same function is possible to use.

15 The second end further comprises at least one connection member, wherein said at least one connection member comprises pin receiving means 309. The pin receiving means 309 may be a track, optionally comprising an internal flange, or individual holes, slots or slits, optionally comprising an internal flange.

20 The pin receiving means 109 of the connector 100 are for engagement with pins 330 arranged on, or located in, the device 300 (schematically shown in Fig. 8b) for arrangement on the sidewall of an intestine or on an end part of an intestine. In this way, the connector 100 and the device 300 for arrangement on the sidewall of an intestine or on an end part of an intestine are engaged in a locking manner. Such a connector 100 is preferably used when the anastomosis is located close to or in the rectum. The pin receiving means 109 of the connector 100 may be in the form of a track, optionally comprising an internal flange, or individual holes, slots or slits, optionally comprising an internal flange. Pins 330 arranged on a device 300 for arrangement on the sidewall of an intestine or on an end part of an intestine may be inserted into the holes or slits 109. The pins 330 on the device 300 for arrangement on the sidewall of an intestine may comprise barbs and the holes or slits 109 on the second end part 103 of the connector 100 may have flanges at their mouths, to interlock the device 300 to the connector 100

at a suitable distance from each other. The pins 230 are preferably of a biocompatible metallic material, but rigid polymers are also envisioned.

In other words, as shown in Fig. 9, a connector 100 as described above may have an integrated part corresponding to the second member 220 of the device 200 for arrangement on the sidewall of an intestine I or on an end part of an intestine I. The second end part 103 extends in a second direction axially from the tubular part 101 of the device. In the particular embodiment shown in Figs. 4 and 5, the radial protrusion 110 corresponds to the second member 220 of the device 200 and is adapted to be in contact with the intestine wall as describe above.

The present disclosure also relates to a device for anastomosis of a tubular structure comprising a symmetrical connector 100 as described above, a device 200 and at least one pin 230. Preferably the device for anastomosis of a tubular structure further comprises a second device 200.

The present disclosure also relates to a device for anastomosis of a tubular structure comprising an asymmetrical connector 100 as described above, a device 200 and at least one pin 230. Preferably the device for anastomosis of a tubular structure further comprises a second device 300.

The present disclosure also relates to a method for mounting a device comprising a symmetrical or essentially symmetrical connector 100 and two devices 200, 200' to a tubular structure, e.g. an intestine I, having a first end and a second end that are to be connected. The method comprises the steps of arranging a first device 200 at the first end of the tubular structure I; connecting a connector 100 and the first device 200; arranging a second device 200' at the second end of the tubular structure I; and connecting the connector 100 and the second device 200' (as shown in Fig. 7).

The present disclosure also relates to a method for mounting a device comprising an asymmetrical connector 100 and two different devices 200, 300 to a tubular structure, e.g. an intestine I, having a first end and a second end that are to be connected. The method comprises the steps of arranging a first device 200 at the first end of the tubular structure I; connecting an asymmetrical connector 100 and the first device 200; arranging a second device 300 at the second end of the tubular structure I; and connecting the connector 100 and the second device 300 (as shown in Fig. 9).

In both methods, the catheters may enter into the lumen of the tubular structure through the second device 200, 300.

In both methods, the pressure is preferably essentially uniformly distributed on the wall of the tubular structure between the elastic part 211 and the second member
5 220 and/or between the elastic part 311 and the radial protrusion 110 of the connector 100.

During removal of a tumour from an intestine I, the affected part of the intestine is removed by cutting the intestine on a suitable distance on each side of the intestine. Depending on where and how the tumour was located, there may be a need to connect
10 the side of one of the free ends of the intestine with a side of the other free end of the intestine, or there may be a need to connect the side of one free end with the other free end. A connector according to the present disclosure and a device for anastomosis of a tubular structure according to the present disclosure allow for creating a connection through the side of one such free end or between two free ends.

15 When connecting the side of a free end of an intestine I, the open end is first closed with sutures. Then the intestine I is incised at a suitable position. Thereafter, the first member 210 of a device 200 for arrangement on the sidewall of an intestine I is inserted through the incision, and is placed in the lumen of the intestine I, such that the second axial end thereof is in contact with the inner wall of the intestine I and said first
20 member 210 further being positioned around the incision created during the incising of the wall of the tubular structure I. After positioning the first member 210 within the intestine I, the incision may be decreased in size with sutures, to facilitate arrangement of the first member 210 around the incision. Alternatively, when the open end of an intestine I is to be connected, the first member 210 of a device 200 for arrangement on
25 the sidewall of an intestine I is inserted into the open intestine, such that the second axial end thereof is in contact with the inner wall of the intestine I. Thereafter, the size of the open end is decreased with sutures to facilitate arrangement of the first member 210.

After positioning the first member 210 within the lumen of the intestine I, the
30 second member 220 is positioned correspondingly on the outside of the intestine I. The second member 220 comprises a first and a second axial end. The first end of the second

member 220 matches the shape of the second axial end of the elastic part 211, such that an intestine I wall may be uniformly distributed between the second axial end of the elastic part 211 and the second member 220. For connecting the first member 210 to the second member 220 a connection member 230 is provided. Preferably, the connection member is a pin 230 which is introduced into a hole 209, track, slit or slot located in the rigid support 212. Thus, the second member 220 may be brought into connection with the first member 210 by inserting the pins 230 into the holes 209, track, slots or slits located in the rigid support 212. The pins 230 may comprise barbs and the holes 209, track, slots or slits on the rigid support part 212 on the first member 210 may have flanges at their mouths, to interlock the first member 210 to the second member 220 at a suitable distance from each other, at which the intestine I is squeezed between the elastic part 211 of the first member 210 and the second member 220.

The second member 220 is preferably made of a polymeric material, more specifically a biocompatible material and most specifically a biodegradable material. The pins 230 are preferably of a biocompatible metallic material, but rigid polymers are also envisioned. The intestine interacting part of the second member 220 has a concave intestine/elastic part seat 213 at its first axial end, intended to face the intestine I and the first member 210, such that the round shape of the elastic part 211, shaping the intestine I in contact therewith, may sit on the second member 220 in a convenient way (see Fig. 7).

When bringing the first member 210 and the second member 220 together, the pins 230 will penetrate the wall of the intestine I around the incision, where after they will enter the holes 209, track, slots or slits on the rigid support part 212 of the first member 210. Then the barbs and the flanges, if present, will interact to interlock the first member 210 to the second member 220. In this way, the first member 210 and the second member 220 are connected to each other, radially inwards of the elastic part 211, and the intestine wall I is squeezed at a uniform pressure between the elastic part 211 of the first member 210 and the concave intestine/elastic part seat 213.

Thereafter, the superfluous intestine tissue around the incision within the edges of the first member 210 and the second member 220 may be cut along the inner edges of the first member 210 and the second member 220.

A connector 100 is attached to the device 200 for arrangement on the sidewall of an intestine I or on an end part of an intestine I. The second member 220 of the device 200 comprises at least one circumferential groove 240, which interacts in a locking manner with the flanges 106 a first end part 102 of the connector 100.

5 When a symmetrical or essentially symmetrical connector is used, a second device 200' for arrangement on the sidewall of an intestine or on an end part of an intestine is arranged in a second end of the intestine I as described above. The second device 200' is then attached to the second end part 103 of the connector 100, whereby the two ends of intestine are connected. In this embodiment, the second end part 103 of
10 the connector 100 comprises at least one flange 107, which interacts with at least one groove 240 arranged on the inside of the second member 220 of the second device 200' in a locking manner (see Fig. 7).

 When an asymmetrical connector 100 is used, a second device 300 for arrangement on the sidewall of an intestine or on an end part of an intestine is arranged
15 in a second end of the intestine. The second end of the intestine is closed with sutures and the second device 300 is introduced into the lumen of the intestine I by insertion via the anus. Alternatively, the second device 300 is introduced into the lumen of the intestine I before closing the second end of the intestine. Before attaching the connector 100 to the device 300, the intestine wall is placed such that it covers the second device
20 300. Thus, after positioning the second device 300 within the lumen of the intestine I, the connector 100 is positioned correspondingly on the outside of the intestine I such that the radial protrusion 110 of the connector 100 matches the elastic part 311 of the member 310 of the device 300. The intestine wall is located between the radial protrusion 110 of the connector 100 and the elastic part 311 of the member 310 of the
25 device 300. The intestine wall is essentially uniformly distributed between the elastic part 311 and the radial protrusion 110 of the connector 100. The part of the radial protrusion 110 of the connector 100 facing the intestine wall, i.e. the intestine interacting part of the connector 100 has a concave intestine/elastic part seat, 113 intended to face the intestine I and the first member 310, such that the round shape of
30 the elastic part 311, shaping the intestine in contact therewith, may sit on the connector 100 in a convenient way. For connecting the member 310 to the connector 100, a

connection member is provided. Preferably, the connection member is a pin 330. When bringing the device 300 and the connector 100 together, the pins 330 will penetrate the wall of the intestine, where after they will enter holes 109, a track, slit or slot on the connector 100. Thus, the connector 100 may be brought into connection with the

5 member 310 by inserting the pins 330 into the holes 309, track, slots or slits located in the rigid support 312 and further into the the holes 109, track, slots or slits of the connector 100. Then the barbs and the flanges (similar to the ones described above), if present, will interact to interlock the member 310 to the connector 100. In this way, the member 310 and the connector 100 are connected to each other, radially inwards of the

10 elastic part 311, and the intestine wall is squeezed at a uniform pressure between the elastic part 311 of the member 310 and the concave intestine/elastic part seat 113 of the radial protrusion 110 of the connector 100. Thereafter, the superfluous intestine tissue around the incision within the edges of the member 310 and connector 100 may be cut along the inner edges of the member 310 and the connector 100.

15 After the two ends of the intestine have healed, the device leaves the body.

Claims

1. A connector (100) for connecting two anastomotic devices, said connector (100) comprising:
- 5 a tubular part (101) having a generally hollow open configuration and being arranged centrally on an axis of the connector (100);
- a first end part (102) extending in a first direction axially from the tubular part (101), wherein said first end part (102) comprises at least one continuous or discontinuous circumferential flange (106), extending radially outwards from the first
- 10 end part (102), and/or at least one continuous or discontinuous circumferential groove (106'), extending radially inwards from the first end part (102); and
- a second end part (103) extending in a second direction axially from the tubular part (101).
- 15 2. A connector according to claim 1, wherein said first and/or second end part comprises at least one circumferential recess (108) on the outer surface of said first and/or second end part, for accommodating a circular sealing member.
- 20 3. A connector according to claim 1 or 2, wherein the tubular part (101) is provided with at least one through hole (104) for connection to a catheter (105).
4. A connector according to claim 3, wherein said catheters exit the connector through said first end part or said second end part.
- 25 5. A connector according to any one of claims 1 to 4, wherein said second end part comprises a circumferential flange (107), extending radially outwards from the second end part (103), and or at least one circumferential groove, extending radially inwards from the second end part (103).
- 30 6. A connector according to any one of claims 1 to 4, wherein said second end part comprises a radial protrusion (110) adapted to be in contact with the intestine wall.

7. A connector according to claim 6, wherein said second end part further comprises at least one connection member, preferably wherein said at least one connection member comprises pin receiving means (109).

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8. A connector according to claim 7, wherein said pin receiving means (109) comprise flanges at its mouth.

9. A connector according to any one of claims 6 to 8, further comprising a
10 partially closed membrane (111) at said second end part.

10. A device (200) for arrangement on the sidewall of an intestine or on an end part of an intestine, said device (200) comprising:

15 a first member (210) and a second member (220, 220'), wherein the first member (210) comprises an elastic part (211) with a first and a second axial end, and a rigid support (212) arranged at the first axial end of the elastic part (211);

wherein the second member (220, 220') comprises a first and a second axial end, said first end of the second member (220, 220') matching the shape of the second axial end of the elastic part (211), such that an intestine wall may be uniformly distributed
20 between the second axial end of the elastic part (211) and the second member (220, 220'); and

at least one connection member for connecting the rigid support part (212) and the second member (220, 220') to each other, wherein said at least one connection member comprises pin receiving means (209); and

25 wherein the second member (220, 220') comprises at least one continuous or discontinuous circumferential groove (240), arranged on an inside surface of the second member (220) located radially inwards, and/or at least one groove (240'), arranged on an inside surface of the second member (220') located radially outwards, for interaction in a locking manner with at least one flange on a connector according to any one of
30 claims 1 to 9.

11. A device for anastomosis of a tubular structure comprising a connector according to any one of claims 1 to 5, a device according to claim 10 and at least one pin (230).

5 12. A device (300) for arrangement on the sidewall of an intestine or on an end part of an intestine, said device (300) comprising:

 a member (310),

 wherein the member (310) comprises an elastic part (311) with a first and a second axial end, and a rigid support (312) arranged at the second axial end of the
10 elastic part (311),

 said first axial end of the elastic part (311) matching the shape of the radial protrusion of a connector according to any one of claims 6 to 9, such that an intestine wall may be uniformly distributed between the first axial end of the elastic part (311) and the radial protrusion of the connector,

15 wherein said second end further comprises at least one connection member, wherein said at least one connection member comprises pin receiving means (309).

13. A device for anastomosis of a tubular structure comprising a connector according to any one of claims 6 to 9, a device according to claim 10 and at least one
20 pin (230).

14. A method for mounting a device according to claim 11 or 13 to a tubular structure having a first end and a second end that are to be connected, comprising the steps of:

- 25 - arranging a first device (200) at the first end of the tubular structure, wherein the first device (200) is a device (200) according to claim 10;
- connecting a connector (100) according to any one of claims 1 to 9 and the first device (200);
- arranging a second device (200, 300) at the second end of the tubular structure,
- 30 wherein the second device (200) is a device according to claim 10 or according to claim 12; and

- connecting the connector (100) and the second device (200, 300).

15. The method according to claim 14, whereby the catheters enter into the lumen of the tubular structure through the second device (200, 300).

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16. The method according to claim 15, wherein the pressure is essentially uniformly distributed on the wall of the tubular structure between the elastic part (211) and the second member (220) and/or between the elastic part (311) and the radial protrusion (110) of the connector (100).

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