

Description

Title of Invention

DRUG SOLUTION SUPPLY TOOL, DRUG SOLUTION SUPPLY DEVICE AND METHOD FOR PRODUCING DRUG SOLUTION SUPPLY TOOL

Technical Field

[0001] The present invention relates to a drug solution supply tool used for supplying a drug solution, a drug solution supply device, and a method for producing the drug solution supply tool.

Background Art

[0002] Various drug solution supply tools have been developed to apply a drug solution to a human body in a contact manner (see Patent Literature 1). The drug solution supply tool of Patent Literature 1 is attachable to an opening portion of a container in which the drug solution is stored. In detail, the drug solution supply tool includes a tubular base body in which a circular opening region is formed at a distal end to allow the drug solution flowing out through the opening region, a substantially disc-shaped plug portion configured to displace in an axial direction of the base body for opening and closing the opening region of the base body, and a pressing portion configured to press the plug portion to close the opening region.

[0003] The outer shape of the base body is designed to match a shape of the opening portion of the container so that the drug solution supply tool can be attached to the container. The base body includes a retaining portion which is formed in the base body to bulge toward the axis of the base body. The retaining portion is provided at the distal end of the base body to prevent the plug portion from exiting the base body through the opening region. In detail, the retaining portion is configured to come into contact with an outer edge portion of the plug portion in the base body.

[0004] The opening region is closed when the outer edge portion of the plug portion comes into contact with the retaining portion. The pressing portion presses the plug portion to maintain this contact state, and prevents the drug solution from flowing out when the drug solution supply tool is not in use.

[0005] When the drug solution supply tool is used, a user holds the container in a posture in which the opening region of the base body is oriented downward. When the user presses an exposed part of the plug portion against the human body, an external force opposite to the pressing force acts on the plug portion. When the external force exceeds the pressing force of the pressing portion, the plug portion is displaced in the axial direction of the base body and moves away from the retaining portion. The drug solution in the container flows down into a gap between the plug portion and the retaining portion, and flows out of the opening region. The drug solution that has flowed out of the opening region flows into a gap between the human body and the exposed part of the plug portion to be supplied to the human body.

Citation List

Patent Literature

[0006] Patent Literature 1: WO 2017/099235

Summary of Invention**Problems to be Solved by the Invention**

[0007] With regarding to assembly of the drug solution supply tool, the outer edge portion of the plug portion is formed to come into contact with the retaining portion which bulges out in the axial direction of the base body when the plug portion is stored in the base body. Therefore, when the plug portion is pushed to be stored in the base body through the opening region of the base body, the distal end of the base body is spread out by the plug portion. When the plug portion is pushed in the axial direction of the base body, the outer surface of the plug portion is strongly rubbed by the base body because of a restoring force resultant from the deformation of the distal end of the base body. If a frictional force between the plug portion and the base body increases excessively, the plug portion may be scraped by the base body. As a result, burrs occur from the plug portion.

[0008] If the burrs of the plug portion are sandwiched between the retaining portion and the outer edge portion of the plug portion to cause a gap between these, the drug solution can flow out even without the above-described external force. In short, the burrs of the plug portion may cause unintended outflow of the drug solution.

[0009] It is an object of the present invention to provide the drug solution supply tool and the drug solution supply device to cause few burrs of the plug portion.

Means for Solving the Problems

[0010] A drug solution supply tool according to one aspect of the present invention is attachable to a container in which a drug solution is stored. The drug solution supply tool includes: a tubular base body attachable to an opening portion of the container and having an opening region formed at a distal end, the drug solution being allowed to flow out through the opening region; a plug portion configured to displace in an axial direction of the base body for opening and closing the opening region; and a pressing portion configured to press the plug portion to close the opening region. The base body includes a retaining portion having a ridge bulging toward an axis of the base body to prevent the plug portion from exiting the base body through the opening region. The plug portion includes an outer edge portion configured to close the opening region by abutting on the retaining portion and is formed by using a resin harder than the base body.

[0011] According to the above-described configuration, since the plug portion includes the outer edge portion configured to close the opening region by abutting on the retaining portion, it is necessary to deform the base body to spread out the distal end of the base body in order to place the plug portion in the base body through the opening region. In this case, the outer edge portion of the plug portion comes into strong contact with the retaining portion of the base body by a restoring force resultant from the deformation of the base body. Since the plug portion is formed by using a resin harder than the base body, the plug portion is less likely to be scraped by the base body even if there is a strong contact with the retaining portion of the base body. As a result, burrs are less likely to occur from the plug portion.

[0012] With regard to the above-described configuration, the outer edge portion may include an

inclined surface which is inclined so that the plug portion gradually narrows toward a proximal end side.

[0013] According to the above-described configuration, since the inclined surface of the outer edge portion of the plug portion is inclined so that the plug portion gradually narrows toward a proximal end side, the distal end of the base body is gradually spread out by the inclined surface when the plug portion is pushed into the base body. Since the deformation of the distal end of the base body becomes less rapid, the plug portion is easily fitted into the base body.

[0014] With regard to the above-described configuration, the ridge may include a curved outer shape in a longitudinal cross-section.

[0015] According to the above-described configuration, the ridge of the retaining portion comes into strong contact with the outer edge portion of the plug portion when the plug portion is fitted into the base body through the opening region. The ridge having a curved outer shape in the longitudinal cross-section is unlikely to be scraped even when coming into strong contact with the outer edge portion of the plug portion. Therefore, burrs are less likely to occur from the base body.

[0016] With regard to the above-described configuration, the pressing portion may be integrally formed with the plug portion.

[0017] According to the above-described configuration, since the pressing portion is integrally formed with the plug portion, the pressing portion may be formed by using the same resin as the plug portion. Since the plug portion is formed by using a hard resin, the pressing portion has a large elastic modulus when the pressing portion is formed by using this resin, so that the pressing portion may apply a large pressing force to the plug portion. In addition, the pressing portion may be stored in the base body together with the plug portion.

[0018] A drug solution supply device according to another aspect of the present invention includes the above-described drug solution supply tool, and a container in which a drug solution is stored, an opening portion being formed on the container. The drug solution supply tool is attached to the opening portion of the container.

[0019] A method for production according to another aspect of the present invention may be used for producing a drug solution supply tool attachable to a container in which a drug solution is stored. The method for production includes: molding a tubular base body attachable to an opening portion of the container so that the tubular base body has an opening region formed at a distal end, the drug solution being allowed to flow out through the opening region; molding a plug portion by using a resin harder than the base body, the plug portion being configured to displace in an axial direction of the base body for opening and closing the opening region; and fitting the plug portion into the base body through the opening region.

Advantageous Effects of the Invention

[0020] The drug solution supply tool, the drug solution supply device, and the method for producing the drug solution supply tool of the present invention may less likely to cause burrs from the plug portion when the plug portion is fitted into the base body.

Brief Description of Drawings

[0021] FIG. 1 is a schematic front view of a drug solution supply device.

FIG. 2 is a schematic front view of a plug portion and a pressing portion of the drug solution supply tool.

FIG. 3 is a schematic perspective view of the plug portion and the pressing portion of the drug solution supply tool.

FIG. 4 is a schematic perspective view of the plug portion and the pressing portion of the drug solution supply tool.

FIG. 5 is a schematic longitudinal cross-sectional view of a base body of the drug solution supply tool.

FIG. 6 is a schematic perspective view of the base body of the drug solution supply tool.

FIG. 7 is a schematic front view of a plug portion of another drug solution supply tool.

FIG. 8 is a schematic perspective view of the plug portion stored in the base body.

FIG. 9 is a schematic perspective view of the plug portion attached to the plug portion.

Description of Embodiment

[0022] A drug solution supply device is a product which has a container and a drug solution supply tool attached to an opening portion of the container (for example, spout of a drug solution into the container). FIG. 1 is a schematic cross-sectional view of a drug solution supply device. The drug solution supply tool includes a plug portion 100 and a pressing portion 300 shown in FIGS. 2 to 4, and a tubular base body 200 shown in FIGS. 5 and 6. The plug portion 100 and the pressing portion 300 are members to be stored in the base body 200. FIG. 2 is a schematic front view of the plug portion 100 and the pressing portion 300. FIGS. 3 and 4 are schematic perspective views of the plug portion 100 and the pressing portion 300. FIG. 5 is a schematic longitudinal cross-sectional view of the base body 200 attached to a mouth tube 500 forming the opening portion of the container. FIG. 6 is a schematic perspective view of the base body 200.

[0023] The base body 200 is a member molded into a generally cylindrical shape by using resin (for example, high density polyethylene (HDPE)). In detail, the base body 200 includes an insertion tube 210 configured to be inserted into the mouth tube 500 and an exposure tube 220 exposed from the mouth tube 500.

[0024] The insertion tube 210 includes a tapered tube 211 that tapers in an insertion direction into the container (proximal end side), and an intermediate tube 212 between the tapered tube 211 and the exposure tube 220. The inner peripheral surface of the tapered tube 211 is substantially parallel to the axis of the base body 200 whereas the outer peripheral surface of the tapered tube 211 is inclined with respect to the axis of the base body 200. The inclination of the outer peripheral surface of the tapered tube 211 is provided to facilitate insertion of the base body 200 into the mouth tube 500.

[0025] The outer peripheral surface of the intermediate tube 212 is substantially parallel to the axis of the base body 200 and is entirely in contact with the inner peripheral surface of the mouth tube

500. The inner peripheral surface of the intermediate tube 212 is substantially parallel to the axis of the base body 200 except for a vicinity of its upper end, and is formed to be flush with the inner peripheral surface of the tapered tube 211. The distal end portion of the inner peripheral surface of the intermediate tube 212 is inclined with respect to the axis of the base body 200 to form a space that narrows toward the proximal end side. The inclination of the distal end portion of the inner peripheral surface of the intermediate tube 212 is provided to facilitate insertion of the pressing portion 300 into the base body 200.

[0026] The insertion tube 210 further includes a bottom ring 213 which protrudes from a proximal end of the inner peripheral surface of the tapered tube 211 toward the axis of the base body 200, and a plurality of resistance protrusions 214 protruding from the bottom ring 213 in the opening direction (distal end side) of the mouth tube 500. The bottom ring 213 is provided to support the plug portion 100 and the pressing portion 300 in the base body 200. The resistance protrusions 214 are formed at substantially regular intervals around the axis of the base body 200 (in short, in the circumferential direction). Each of the resistance protrusions 214 has a triangular prism shape, and one of corners of the triangular prism is formed to be oriented in the opening direction of the mouth tube 500. The resistance protrusions 214 are provided to give resistance to a rotation of the plug portion 100 when the plug portion 100 rotates around the axis of the base body 200.

[0027] The exposure tube 220 is formed on the distal end side of the insertion tube 210. The exposure tube 220 includes an annular shoulder surface 221 which is larger in outer diameter than the insertion tube 210 and extends outward in the radial direction from the distal end of the insertion tube 210. The shoulder surface 221 abuts on the distal end edge surface of the mouth tube 500 to prevent the base body 200 from being pushed into the container from this position.

[0028] The exposure tube 220 forms an opening region 222 at the distal end. The opening region 222 is formed to allow the outflow of the drug solution. The opening region 222 is wider than the opening region at the proximal end of the insertion tube 210 (in short, region surrounded by the inner peripheral edge of the bottom ring 213).

[0029] In order to prevent the plug portion 100 from exiting the base body 200 through the opening region 222, a retaining portion 224 is formed to bulge toward the axis of the base body 200 in the exposure tube 220. The retaining portion 224 has a tip which is curved in the longitudinal cross-section. A ridgeline connecting the tip in the circumferential direction is an opening edge 223 surrounding the opening region 222. The retaining portion 224 forms a space that becomes wide toward the proximal end side from the opening region 222.

[0030] The inner peripheral surface of the exposure tube 220 includes a tapered surface 225 which forms a space wider in the opposite direction of the above-described space surrounded by the retaining portion 224. The retaining portion 224 and the tapered surface 225 form a recessed space in which the inner peripheral surface of the exposure tube 220 is recessed outward in the radial direction. The recessed space is formed to store the plug portion 100 with allowing displacement of the plug portion 100 in the axial direction of the base body 200.

[0031] An annular restriction surface 226 is formed to face the opening region 222 in the exposure tube 220. The restriction surface 226 is provided to restrict the displacement of the plug portion 100 to the proximal end side.

[0032] The plug portion 100 is a generally disk-shaped member molded by using a resin harder than the base body 200. In the present embodiment, hardness of resin is evaluated by using the flexural elastic modulus measured by the test method defined by ISO178 or JISK7171. If the base body 200 is molded by using high density polyethylene, the plug portion 100 may be molded by using polyoxymethylene (POM). In this case, the flexural elastic modulus of the plug portion 100 is 2,500 MPa whereas the flexural elastic modulus of the base body 200 is 1,000 MPa.

[0033] The plug portion 100 includes a first tapered portion 101 having an exposed portion 110 exposed from the opening region 222 on the distal end side, and a second tapered portion 102 including a proximal end surface 120 oriented to the opposite side of the exposed portion 110. The first tapered portion 101 includes a truncated cone-shaped portion that gradually narrows toward the exposed portion 110 on the distal end side. The second tapered portion 102 is a substantially truncated cone-shaped portion that gradually narrows toward the proximal end surface 120. In these truncated cone-shaped portions, the plug portion 100 has a substantially hexagonal longitudinal cross-section.

[0034] The exposed portion 110 of the first tapered portion 101 includes an application surface 111, which is substantially circular and substantially as large in diameter as the opening region 222, and three massage bumps 112 bulging from the application surface 111. The application surface 111 is used to apply the drug solution to the human body in a contact manner, the drug solution having flowed out of the opening region 222. The massage bump 112 is used to massage the human body part in contact with the application surface 111.

[0035] The application surface 111 is curved to smoothly rise from the opening region 222. Three liquid storage recesses 113 (circular recesses) are formed at intervals in the circumferential direction on the application surface 111. The liquid storage recesses 113 are formed at substantially regular intervals. The liquid storage recesses 113 are used to store the drug solution that has flowed to the application surface 111 through the opening region 222.

[0036] The three massage bumps 112 are substantially hemispherical parts formed at intervals in the circumferential direction. In detail, the massage bumps 112 are formed such that the bulge directions of the three massage bumps 112 is such that the axes of the massage bumps 112 are inclined outward in the radial direction.

[0037] The three massage bumps 112 are formed among the three liquid storage recesses 113. Therefore, the massage bumps 112 and the liquid storage recesses 113 are formed alternately side by side in the circumferential direction.

[0038] The proximal end surface 120 of the second tapered portion 102 includes an annular and flat band region formed along the outer peripheral edge of the proximal end surface 120. The proximal end surface 120 is smaller in diameter than the opening region, the diameter of the

proximal end surface 120 being substantially as large as the outer diameter of the restriction surface 226. The flat band region of the proximal end surface 120 faces the restriction surface 226.

[0039] An annular outer edge portion 130 of the plug portion 100 includes outer peripheral surfaces of the first tapered portion 101 and the second tapered portion 102. A ridgeline 133 forming the boundary of the outer peripheral surfaces of the first tapered portion 101 and the second tapered portion 102 surrounds a part of the plug portion 100 having the widest cross section. The outer edge portion 130 bulges outward in the radial direction with respect to the outer peripheral edge of the application surface 111 and the proximal end surface 120 such that the plug portion 100 has a cross section that increases from the application surface 111 and the proximal end surface 120 to the ridgeline 133. The diameter of the circular region surrounded by the ridgeline 133 is larger than the diameter of the opening region 222. The ratio of these diameters (diameter of circular region surrounded by ridgeline 133/diameter of opening region 222) is set in the range of 1.0 to 1.1, preferably 1.02 to 1.06, and more preferably 1.03 to 1.05. This diameter ratio is set not to cause plastic deformation of the base body 200 when the plug portion 100 is fitted into the base body 200.

[0040] The bulge shape of the outer edge portion 130 is substantially complementary to the recessed space formed by the retaining portion 224 and the tapered surface 225 of the base body 200. The outer peripheral surface of the first tapered portion 101 faces the retaining portion 224 and is referred to as "contact surface 132" in the following description. The outer peripheral surface of the second tapered portion 102 faces the tapered surface 225 and is referred to as "inclined surface 131" in the following description. The shape of the contact surface 132 is designed such that the contact surface 132 is in surface contact with the retaining portion 224. The inclination angle of the inclined surface 131 is set not to cause abrupt deformation of the base body 200 when the plug portion 100 is fitted into the base body 200.

[0041] The width of the outer edge portion 130 (size in the axial direction of the base body 200) is less than the thickness of the recessed space formed by the retaining portion 224 and the tapered surface 225 (in short, size of the recessed space in the axial direction of the base body 200). Therefore, the plug portion 100 may be moved in the axial direction of the base body 200 in the recessed space.

[0042] The pressing portion 300 is configured to elastically support the plug portion 100. The pressing portion 300 is integrally molded with the plug portion 100 by using the same resin as the plug portion 100, and is formed separately from the base body 200. Since the resin of the plug portion 100 is relatively hard as described above, the pressing portion 300 has a large elastic modulus.

[0043] The pressing portion 300 includes a support ring 310 placed on the bottom ring 213 and three elastic legs 320 extending from the support ring 310 to the proximal end surface 120 of the plug portion 100. The inner and outer diameters of the support ring 310 are substantially coincident with the inner and outer diameters of the bottom ring 213. Each of the three elastic legs 320 includes a spiral leg 321 extending toward the plug portion 100 with curving in an arc shape to

overlap the support ring 310 in a plan view, and a distal end leg 322 extending from the distal end of the spiral leg 321 substantially in parallel to the axis of the base body 200. The proximal ends of the three spiral legs 321 are connected to the support ring 310 at substantially regular intervals in the circumferential direction. The three distal end legs 322 are connected to the proximal end surface 120 at substantially regular intervals in the circumferential direction. The connection portions of the distal end legs 322 and the proximal end surface 120 are set inside the outer peripheral edge of the proximal end surface 120 such that the distal end leg 322 does not interfere with the part of the base body 200 that forms the annular restriction surface 226. The height of the elastic leg 320 is set such that the elastic legs 320 are compressed in the axial direction of the base body 200 when the plug portion 100 and the pressing portion 300 are stored in the base body 200.

[0044] The drug solution supply tool further includes a resistance portion 400 configured to give resistance to rotation around the axis of the plug portion 100 in collaboration with the resistance protrusion 214 of the base body 200. The resistance portion 400 is integrally molded with the support ring 310. The resistance portion 400 includes three protrusions 410 protruding from the proximal end surface of the support ring 310 facing the bottom ring 213. The protrusions 410 are formed at substantially regular intervals. Each of these protrusions 410 has substantially a triangular pyramid shape. The apex of the triangular pyramid of each protrusion 410 is in contact with the bottom ring 213. The protrusion 410 is situated between adjacent resistance protrusions 214.

[0045] The drug solution supply tool opens and closes the opening region 222 by using elastic deformation of the pressing portion 300. Since the elastic leg 320 of the pressing portion 300 stored in the base body 200 is in a compressed state, the pressing portion 300 causes a pressing force on the plug portion 100 in the direction of pushing the plug portion 100 out of the opening region 222. As a result, the contact surface 132 of the outer edge portion 130 of the plug portion 100 becomes in surface contact with the retaining portion 224 of the base body 200. The surface contact region of the contact surface 132 and the retaining portion 224 functions as a seal region to prevent the drug solution from flowing out of the opening region 222.

[0046] When the drug solution supply tool is used to apply the drug solution, the container to which the drug solution supply tool is attached is held so that the application surface 111 is oriented downward. When the application surface 111 is pressed against the human body part so that an external force pressing the application surface 111 exceeds the elastic force of the pressing portion 300, the plug portion 100 is displaced inward of the base body 200 (in short, upward) in the axial direction of the base body 200. As a result, the contact surface 132 is separated from the retaining portion 224, and the opening region 222 becomes in communication with the inner space of the container. The drug solution in the container flows out of the opening region 222 under the influence of gravity.

[0047] When the plug portion 100 is pushed further into the base body 200, the flat band region of the proximal end surface 120 of the plug portion 100 abuts on the restriction surface 226, so that the

displacement of the plug portion 100 is restricted by the restriction surface 226. Since both the band region of the proximal end surface 120 and the restriction surface 226 are flat, the flat band region of the proximal end surface 120 and the restriction surface 226 become in surface contact with each other. The surface contact region between the proximal end surface 120 and the restriction surface 226 functions as a seal region to prevent the drug solution from flowing out of the opening region 222.

[0048] The outflow amount of the drug solution from the opening region 222 becomes a peak value when the space between the contact surface 132 and the retaining portion 224 is substantially as large as the space between the proximal end surface 120 and the restriction surface 226. The outflow amount decreases when the external force for pressing the application surface 111 not only decreases but also increases from this state. Therefore, the excessive outflow of the drug solution is suppressed when the pressing force on the application surface 111 increases.

[0049] The drug solution that has flowed out of the opening region 222 is supplied to the application surface 111. A part of the drug solution between the application surface 111 and the human body part is stored in the liquid storage recesses 113. Since the amount of drug solution to be held between the application surface 111 and the human body part increases by the volume of the liquid storage recesses 113, it is likely to prevent the drug solution from dripping from the application surface 111. While the application surface 111 is rubbed against the human body part, the drug solution may be continuously supplied to the human body part because the drug solution is stored in the liquid storage recesses 113 even if the external force pressing the application surface 111 weakens or strengthens so that the plug portion 100 closes the opening region 222.

[0050] While the application surface 111 is rubbed against the human body part, the massage bump 112 massages the human body part. When a force to press the human body part is weakened, the plug portion 100 comes into contact with the retaining portion 224 to stop the outflow of the drug solution from the opening region 222. Conversely, when the pressure on the human body part is strengthened, the plug portion 100 comes into contact with the restriction surface 226 to stop the outflow of the drug solution. Even in these cases, the liquid storage recess 113 enables continuous supply of the drug solution.

[0051] During the massage to the human body part, a force may act to rotate the plug portion 100 around the axis of the base body 200. When the plug portion 100 rotates in response to this force, the protrusion 410 of the resistance portion 400 moves around the axis of the base body 200 while in contact with the support ring 310. Since the contact portion of the protrusion 410 is the apex of the triangular pyramid, the contact area of the protrusion 410 and the support ring 310 is small. Therefore, while the protrusion 410 moves in a movement section between adjacent resistance protrusions 214, the drug solution supply tool gives little resistance to the rotation of the plug portion 100. On the other hand, when the protrusion 410 comes into contact with the adjacent resistance protrusion 214, the drug solution supply tool causes strong resistance to the rotation of the plug portion 100 and stops the rotation of the plug portion 100.

[0052] With regard to the assembly of the drug solution supply tool, the plug portion 100 is first placed on the opening region 222. Since the proximal end surface 120 of the plug portion 100 is smaller than the opening region 222, a part of the second tapered portion 102 goes into the base body 200. Thereafter, when the second tapered portion 102 is pushed into the base body 200 in the axial direction, the second tapered portion 102 gradually spreads out the distal end of the base body 200. Since the second tapered portion 102 does not have a shape to suddenly spread out the opening region 222, the plug portion 100 is easily fitted into the base body 200.

[0053] The restoring force of the base body 200 caused by the spread of the opening region 222 is added to the outer edge portion 130 of the plug portion 100 through the retaining portion 224. The restoring force increases as the contact portion of the plug portion 100 with respect to the retaining portion 224 approaches the ridgeline 133. In short, when the plug portion 100 is fitted into the base body 200, the outer edge portion 130 of the plug portion 100 rubs against the retaining portion 224 under a condition that the retaining portion 224 causes a strong restoring force on the outer edge portion 130 of the plug portion 100. Even in such a situation, since the plug portion 100 is formed by using a resin (polyoxymethylene) harder than the base body 200, the outer edge portion 130 of the plug portion 100 is unlikely to be scraped by the retaining portion 224. In short, burrs are less likely to occur from the plug portion 100. In addition, since polyoxymethylene is used for molding the plug portion 100, the plug portion 100 has high slidability.

[0054] Burrs from the base body 200 are suppressed by the longitudinal cross-sectional shape of the retaining portion 224. In detail, the retaining portion 224 has a curved ridge around the opening edge 223. Therefore, even if the ridge of the retaining portion 224 strongly rubs against the outer edge portion 130 of the plug portion 100, burrs are less likely to occur from the retaining portion 224.

[0055] When the plug portion 100 is fitted into the base body 200 to some extent that the ridgeline 133 of the plug portion 100 goes beyond the opening region 222, the retaining portion 224 comes into contact with the first tapered portion 101 of the plug portion 100. The first tapered portion 101 of the plug portion 100 is tapered in the opposite direction of the second tapered portion 102, so that a part of the restoring force acts in the direction of pushing the plug portion 100 into the base body 200. Therefore, when the plug portion 100 is pushed into the base body 200 to some extent, the plug portion 100 is then easily stored in the base body 200.

[0056] With regard to the above-described embodiment, the base body 200 is molded by using high density polyethylene (HDPE), and the plug portion 100 is molded by using polyoxymethylene (POM). Alternatively, the base body 200 may be molded by using other resin materials such as low density polyethylene (LDPE) and polypropylene (PP). The plug portion 100 may be molded by using other resin materials such as high density polyethylene (HDPE) and polypropylene (PP).

[0057] With regard to the above-described embodiment, the flexural elastic modulus of the plug portion 100 is higher than the flexural elastic modulus of the base part 200. In detail, the molding resin for the plug portion 100 may be selected such that the flexural elastic modulus of the plug

portion 100 is 1500 MPa or more and 4000 or less. Preferably, the flexural elastic modulus of the plug portion 100 is 2000 MPa or more and 3500 MPa or less. More preferably, the flexural elastic modulus of the plug portion 100 is 2500 MPa or more and 3000 MPa or less. The molding resin for the base part 200 may be selected such that the flexural elastic modulus of the base part 200 is 500 MPa or more and 1500 MPa or less. The molding resin for the plug portion 100 and the base part 200 may be selected such that a difference in the flexural elastic modulus between these parts is 1000 MPa or more.

[0058] With regard to the above-described embodiment, the pressing portion 300 is formed by using the same resin as the plug portion 100. Therefore, the pressing portion 300 may be formed by using a resin material such as polyoxymethylene (POM), high density polyethylene (HDPE), and polypropylene (PP) that can be used to mold the plug portion 100. Alternatively, the pressing portion 300 may be molded by using a resin material different from the plug portion 100. For example, when the plug portion 100 is molded using high density polyethylene (HDPE) or polypropylene (PP), the pressing portion 300 may be molded by using polyoxymethylene (POM).

[0059] Since the pressing portion 300 can be molded by using a resin material different from the plug portion 100, the flexural elastic modulus of the pressing portion 300 may be different from the flexural elastic modulus of the plug portion 100. For example, the flexural elastic modulus of the pressing portion 300 may be set in a range of 2,000 MPa to 4,000 MPa. Preferably, the flexural elastic modulus of the pressing portion 300 is set in a range of 2,500 MPa to 3,000 MPa.

[0060] With regard to the above-described embodiment, the outer edge portion 130 of the plug portion 100 is entirely stored in the base body 200. Alternatively, a part of the outer edge portion 130 may be exposed from the opening region 222 of the base body 200. In this case, the plug portion 100 is formed such that the region surrounded by the outer edge portion of the remaining part stored in the base body 200 is larger than the opening region 222 of the base body 200. As a result, the plug portion 100 is caught by the retaining portion 224 to prevent the plug portion 100 from exiting the base body 200.

[0061] With regard to the above-described embodiment, the protrusion 410 of the resistance portion 400 and the resistance protrusions 214 are provided to prevent the rotation of the plug portion 100. However, the shapes of the protrusion 410 and the resistance protrusions 214, and the elastic force of the pressing portion 300 may be designed such that the resistance protrusions 214 run on the protrusions 410 when the plug portion 100 is rotated by a strong force. When the resistance protrusions 214 run on the protrusions 410, the elastic leg 320 of the pressing portion 300 is compressively deformed in the axial direction of the base body 200. As a result, a restoring force of the elastic leg 320 increases. Since the increase in the restoring force is added to a force given by the user to the human body part, the pressing force on the human body part further increases, so that the massage effect increases.

[0062] With regard to the above-described embodiment, the pressing portion 300 is integrally molded with the plug portion 100. Alternatively, the pressing portion 300 may be molded

separately from the plug portion 100. The drug solution supply tool including the pressing portion 300 molded separately from the plug portion 100 is described with reference to FIGS. 7 to 9. FIG. 7 is a schematic front view of the pressing portion 300 molded separately from the plug portion 100. FIG. 8 is a schematic perspective view of the pressing portion 300 stored in the base body 200. FIG. 9 is a schematic perspective view of the plug portion 100 attached to the pressing portion 300 of FIG. 7.

[0063] The pressing portion 300 in FIG. 7 is different from the pressing portion 300 shown in FIG. 2 only in that a ring member 330 is provided to be connected to the distal end of the distal end leg 322 of the elastic leg 320. The ring member 330 is smaller in outer diameter than the support ring 310. A cross-shaped through hole 331 is formed in the center of the ring member 330 as shown in FIG. 8. The through hole 331 is extended in the axial direction of the base body 200.

[0064] The pressing portion 300 is stored in the base body 200 as shown in FIG. 8. When no external force is applied to the elastic leg 320, the surface of the ring member 330 opposite to the surface to which the elastic leg 320 is connected may be situated in the internal space of the exposure tube 220 surrounded by the retaining portion 224 and the tapered surface 225 (see FIG. 1). Alternatively, when no external force is applied to the elastic leg 320, the ring member 330 may protrude to the distal end side from the internal space of the exposure tube 220.

[0065] The plug portion 100 in FIG. 9 is different from the plug portion 100 in FIG. 1 only in that a shaft 122 is provided to protrude from the center of the proximal end surface 120 to the proximal end side. The shaft 122 has a cross-shaped cross section complementary to the cross-shaped through hole 331 of the ring member 330.

[0066] The shaft 122 of the plug portion 100 is inserted into the through hole 331 of the ring member 330 after the pressing portion 300 is stored in the base body 200. Thereafter, the plug portion 100 is pushed to the proximal end side so that the plug portion 100 is pushed into the base body 200.

[0067] With regard to the drug solution supply tool described with reference to FIGS. 7 to 9, since the pressing portion 300 is separate from the plug portion 100, the resin material may be easily differentiated between the pressing portion 300 and the plug portion 100. In short, the resin material used for molding the pressing portion 300 may be selected independently of the resin material of the plug portion 100 such that the elastic force required for the pressing portion 300 may be obtained.

[0068] The rotation of the plug portion 100 is prevented by the engagement of the shaft 122 with the cross-shaped through hole 331. Therefore, the drug solution supply tool may be used without rotating the plug portion 100.

Industrial Applicability

[0069] The drug solution supply tool and the drug solution supply device of the above-described embodiment may be suitably used together with the container in which the drug solution is stored.

Reference Signs

[0070]

- 100 plug portion
- 130 outer edge portion
- 131 inclined surface
- 200 base body
- 222 opening region
- 224 retaining portion
- 300 pressing portion

Claims

1. A drug solution supply tool attachable to a container in which a drug solution is stored, the drug solution supply tool comprising:
 - a tubular base body attachable to an opening portion of the container and having an opening region formed at a distal end, the drug solution being allowed to flow out through the opening region;
 - a plug portion configured to displace in an axial direction of the base body for opening and closing the opening region; and
 - a pressing portion configured to press the plug portion to close the opening region, wherein the base body includes a retaining portion having a ridge bulging toward an axis of the base body to prevent the plug portion from exiting the base body through the opening region, and
 - wherein the plug portion includes an outer edge portion configured to close the opening region by abutting on the retaining portion and is formed using a resin harder than the base body.
2. The drug solution supply tool according to claim 1,
 - wherein the outer edge portion includes an inclined surface which is inclined so that the plug portion gradually narrows toward a proximal end side.
3. The drug solution supply tool according to claim 1 or 2,
 - wherein the ridge has a curved outer shape in a longitudinal cross-section.
4. The drug solution supply tool according to any one of claims 1 to 3,
 - wherein the pressing portion is integrally formed with the plug portion.
5. A drug solution supply device comprising:
 - the drug solution supply tool according to any one of claims 1 to 4; and
 - a container in which a drug solution is stored, an opening portion being formed on the container,
 - wherein the drug solution supply tool is attached to the opening portion of the container.
6. A method for producing a drug solution supply tool attachable to a container in which a drug solution is stored, the method comprising:
 - molding a tubular base body attachable to an opening portion of the container so that the tubular base body has an opening region formed at a distal end, the drug solution being allowed to flow out through the opening region;
 - molding a plug portion by using a resin harder than the base body, the plug portion being configured to displace in an axial direction of the base body for opening and closing the opening

region; and

fitting the plug portion into the base body through the opening region.