REPLACEMENT TUBE FOR THE LACRIMAL DRAINAGE DUCTS

Inventor: Ralph W. Parker, 908 Frey Road, Pittsburgh, Pa. 15235

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References Cited

UNITED STATES PATENTS

1,688,795 10/1928 Aas 128/348
2,154,966 4/1939 Alkio 128/348
3,176,690 4/1965 H'Doubler 128/348

FOREIGN PATENTS OR APPLICATIONS


OTHER PUBLICATIONS


Primary Examiner—Dalton L. Truluck
Attorney—Don J. Smith

ABSTRACT

A replacement tube for the lacrimal drainage ducts includes a pair of elongated end portions. An expanded portion having a drain passage adjoins adjacent ends respectively of the end portions. Each of the end portions has a drain passage extending therethrough and communicating with the drain passage of the expanded portion. The expanded portion forms relatively abrupt junctions at generally opposite sides thereof with the end portions to prevent rejection of the replacement tube.

20 Claims, 14 Drawing Figures
REPLACEMENT TUBE FOR THE LACRIMAL DRAINAGE DUCTS

The present invention relates to a full-flow replacement tube for the lacrimal drainage ducts and more particularly to the replacement tube of the character described, which, when implanted in the flesh of the patient, will not subsequently become dislodged or rejected.

Lacrimal fluid or tears are, of course, continuously supplied from the lacrimal gland located laterally and superiorly of the eye through the upper lacrimal duct to the conjunctival sac in which the eyeball is partially encased. Thence, the lacrimal fluid washes across the sclera and other conjunctival components and also the cornea. Under normal conditions, excess lacrimal fluid beyond that which is retained by the eye and conjunctiva is drained from the innercanthus to the nasal passages, the inferior nasal meatus in particular. The flow of lacrimal fluid, again under normal conditions, is continuous but in varying amount and when normally excessive the lacrimal fluid may brim over the eyelids in the form of tears. At other times, the excess fluid is drained through a network of passages commencing with the puncta seen as a small papilla adjacent the innercanthus or inner corner of the eye. Thence, the lacrimal fluid is collected in the lacrimal sac by a number of canaliculi connecting the puncta with the lacrimal sac. The canaliculi run inferiorly then medially to the lacrimal sac. The lacrimal sac is drained through its extension, the nasolacrimal duct which passes into the inferior nasal meatus for this purpose. This network of passages is referred to herein and in the claims as the lacrimal drainage ducts.

Quite often a permanent closure occurs in the canaliculi, the lacrimal sac, or the nasolacrimal duct, whereupon the lacrimal fluid no longer can be disposed of in the normal manner. Such closure or stenosis can result from congenital anomalies, accident, inflammation or other disease, or advancing age. In addition, the canaliculi may become scarred from conjunctival infection. Epiphora likewise can result from blockage of the canaliculi by a cillum or by streptothrix concre- tions. In severe cases permanent stenosis occurs and a dacryocystorhinostomy is indicated.

Upon occurrence of blockage in the lacrimal drainage ducts, the eye, of course, is continuously brimming over with tears much to the discomfort, annoyance, and embarrassment of the individual so affected. A much more serious consequence is the potential for the stagnating tears to result in infection and inflammatory irritation of the mucous membrane with proliferation of the epithelium, hyperemia, and a purulent exudation into the conjunctiva.

In some cases the defective portion of the lacrimal drainage system can be reconstructed by surgery, when performing a dacryocystorhinostomy. If blockage occurs in the nasolacrimal duct, for example, the latter can be removed, and the lacrimal sac cavity can be joined directly with the nasal fossa (mucosa) after removing a segment of the nasal bone and periosteam to restore drainage of the tear liquid in a more or less natural manner. In most cases, however, removal of the entire lacrimal drainage system and replacement thereof with a mechanical contrivance or replacement tube by dacryocystorhinostomy is indicated. Although such operations are frequently performed, they are seldom entirely successful. At least two prominent difficulties have been almost uniformly experienced with such operations in the past. In the first instance, although the nasal bone apparently heals about the lower end portion of the replacement tube, the replacement tube gradually is rejected from the bone and flesh of the patient. Secondly, the patient's flesh heals over the upper end of the replacement tube at the innercanthus and must be reopened periodically.

Conventionally, the replacement tube utilized in a dacryocystorhinostomy is a small tube of pyrex glass, stiff plastic or other relatively rigid material. Pyrex glass has been preferred for such embedment or implantation in the flesh of the patient, as it is not destroyed or corroded or otherwise attacked by bodily fluids. The conventional replacement tube is less than an inch in length (typically about 18mm and about 3mm o.d.), and, despite its rigidity, the replacement tube usually works out of the bone and flesh of the patient, either ascending into the eye or descending into the nasal passage. In either eventuality, the function of the replacement tube is lost and a second or subsequent dacryocystorhinostomy usually is indicated. From the rigid character of the replacement tube, the obvious eye hazard is immediately apparent when the replacement tube is rejected superiority from the patient's flesh.

Insofar as I am aware no adequate means or method has been advanced heretofore for assuring retention of the replacement tube for the lacrimal drainage ducts in its intended position. In accordance with my present invention, I therefor provide a configuration of replacement tube for the lacrimal drainage ducts such that the novel replacement tube becomes physically entrapped by the healing flesh of the patient. The replacement tube of the invention therefore cannot be rejected by the individual in whom it is implanted during a dacryocystorhinostomy.

I am aware, of course, of various types of tubes which are constructed for retention within the human body, such as the plastic rectal tube disclosed in the U.S. Pat. to D. S. Sheridan No. 3,042,044. The Sheridan tube is provided with a bulbous region designed to help retain the tube within the patient during use. Obviously the Sheridan tube is considerably larger and is designed for a radically different function than that contemplated for the replacement tube of the present invention.

Moreover, the Sheridan tube is designed for temporary lodgement within the human body, while the replacement tube of the invention is intended as a surgically implanted, permanent accessory. Moreover, the smoothly curving contours of the Sheridan tube would not contribute materially to preventing rejection of a replacement tube even of this general shape from the area between the innercanthus and the adjacent nasal passage. At best the Sheridan tube is designed to delay rejection in a single direction and then only from a normal body passage.

I overcome these difficulties of the prior art by providing a novel replacement tube for the lacrimal drainage ducts which is configured in an unexpected manner with fairly sharp or abrupt junctions to obviate rejection in either direction. When the patients tissues heal about such junction, the patient's body is physi-
3,726,284 3 cally incapable of rejection the replacement tube from the situs of its surgical implantation. In one arrange-
mint of my novel replacement tube, although not the
only modification thereof within the teachings of my in-
vention, the replacement tube is configured with two
more or less constant diameter portions separated by
an expanded portion, such as a blown or molded bub-
ble or other protuberance. The protuberance or protu-
berances make fairly sharp or abrupt outer junctions
with the end portions of the replacement tube for per-
manent retention in the flesh and bone between the eye
and the nasal passage. On the other hand, the constant
 diameter end portions facilitate insertion of the
replacement tube through a passage made in the nasal
bone as required by the dacryocystorhinostomy and
into the innercanthus of the eye at the other end of the
tube. The smooth inner passages of the tube avoid in-
terference with a full flow of lacrimal fluid through the
replacement tube.

There are also provided in accordance with my in-
vention unique means for preventing healing of the
flesh over the upper or inlet end of the replacement
tube. Modification of such means can be further and
unexpectedly arranged for ready removal after healing
of the incision without the use of additional surgery or
the use of surgical instruments, such as probes or for-
ceps.

The replacement tube can be configured in a linear
fashion, save for the aforementioned protuberance or
protuberances, or it may be bent or curved depending
upon the physical characteristics of an individual pa-
tient. For example the replacement tube may be curv-
ed for more direct passage through the septum in the case
of a patient having closely spaced eyes. It is also con-
templated that the replacement tube can be provided with
protuberances in series for further retentional as-
surance. Likewise the protuberance may be relatively
larger for retention in the soft tissues of the patient, or
may be made relatively smaller for retention by the
nasal bone tissues. Naturally either of the forms of
protuberances can be utilized without corresponding
usage of the other.

I accomplish these desirable ends by providing a
replacement tube for the lacrimal drainage ducts, said
tube comprising a pair of elongated end portions, an
expanded portion having a drain passage therethrough
and adjoining adjacent ends respectively of said end
portions, each of said end portion having a drain
passage extending therethrough and communicating
with the drain passage of said expanded portion, said
expanded portion forming relatively abrupt junctions at
generally opposite sides thereof with said end portions
respectively to prevent rejection of said replacement
tube in either direction of said end portions.

I also desirably provide a similar replacement tube
for the lacrimal drainage ducts wherein a relatively
flexible cord is inserted into said tube and extends from
the upper end portion thereof when implanted in a pa-
tient to prevent the innercanthus area of the patient
from healing over an inlet opening of said tube.

I also desirably provide a similar replacement tube
for the lacrimal drainage ducts wherein said cord ex-
tends entirely through said tube and protrudes from a
lower end thereof when so implanted to permit grasp-
ing and pulling of the cord downwardly through said
tube.

I also desirably provide a similar replacement tube
for the lacrimal drainage ducts wherein said tube is
fabricated from a glass material and said expanded por-
tion is a blown spheroidal bubble.

During the foregoing discussion, various objects, fea-
tures and advantages of the invention have been set
forth. These and other objects, features and advantages
of the invention together with structural details thereof
will be elaborated upon during the forthcoming
description of certain presently preferred embodiments
of the invention and presently preferred methods of
practicing the same.

In the accompanying drawings, I have shown certain
presently preferred embodiments of the invention and
have illustrated certain presently preferred methods of
practicing the same wherein:

FIG. 1 is an isometric view of one form of replace-
ment tube for the lacrimal drainage ducts, according to
my invention;

FIG. 1A is an enlarged cross-sectional view of the
replacement tube as shown in FIG. 1 and taken along
reference line IA—IA thereof;

FIG. 1B is a frontal view of a surgical implantation of
my novel replacement tube;

FIG. 2 is a similar view of a modified form of my
replacement tube having means associated therewith
for preventing the patient's flesh from healing over the
inlet end of the tube;

FIG. 3 is a frontal view showing still another form of
my replacement tube, as surgically implanted in a pa-
tient;

FIG. 4 is an isometric view of a further modification
of the replacement tube which will be used for example
in a patient having more closely spaced eyes;

FIG. 5 is a frontal view of still another arrangement
of the replacement tube surgically implanted in a
similar patient;

FIG. 6 is a similar view showing still another modifi-
cation of the replacement tube arranged in this ex-
ample for retention by the nasal bone tissues of the pa-
tient;

FIG. 7 is a cross-sectional view of another replace-
ment tube arranged according to the invention;

FIG. 7A is a cross-sectional view of the replacement
tube shown in FIG. 7 and taken along reference line
VIIA—VIIA thereof;

FIG. 7B is a similar view showing another modifica-
tion of the replacement tube of the invention;

FIGS. 8A and 8B are isometric views of replacement
tubes of the invention having differing forms of reten-
tion means, and FIG. 9 is another frontal view of a sur-
gical implantation of my novel tube.

Referring now to FIGS. 1 – 1B of the drawings, a
unique replacement tube 20 for the lacrimal drainage
ducts is illustrated in one modification thereof. As
required, the tube 20 can be provided with substan-
tially the overall dimensions as noted previously, except
of course for its expanded or enlarged section 22. The
tube 20 can be fabricated from a number of materials
such as a glassy composition or a stiff plastic which is
compatible with the human chemistry. For most pa-
tients pyrex glass is preferred as it is not attacked by
body fluids. The expanded portion 22 can be formed by
a variety of techniques, for example by blowing where
the tube 20 is fabricated from the glass or by pinching,
drawing or molding. As better shown in FIGS. 1 – 1A
the expanded portion can be blown adjacent the mid point of the replacement tube 20 and takes the form of a bubble of spheroidal contour. For most patients, the replacement tube 20 desirably is made more or less straight, although other configurations can be used as described below. Likewise, the expanded portion 22 can be provided in configurations other than spheroidal as also described hereinafter.

The replacement tube 20 further consists of a pair of relatively straight end portions 24, 26 each of which contains a longitudinal passage 28 opening into the drain passage or interior of the expanded portion 22 as denoted by reference character 30 (FIG. 1A).

The end portions 24, 26 in the illustrated are in substantial alignment, and are joined to the expanded portion 22 at generally opposite sides thereof. The passages 28 are of sufficient diameter to conduct the normal flow of lacrimal fluid from the eye to the nasal passages. As better shown in FIG. 1B the replacement tube 20 is of sufficient length to extend inferiorly and medially for proper drainage from the innercanthus 32 through the 36 to the inferior nasal meatus 34. Desirably also the junctions 38 of the expanded portion 22 are sufficiently steep or abrupt and the diameter of the expanded section 22 is sufficiently large that the flesh of the patient cannot pull away from these portions of the replacement tube. Thus, the patient's flesh cannot reject the tube either in the superior or in the inferior direction.

During the dacryocystorhinostomy the aforementioned puncta, canaliculi, lacrimal sac, and nasolacrimal duct are removed, whereupon the replacement tube is surgically implanted in the patient's incision for example in the position as shown in FIG. 1B. A hole 40 (FIG. 1B) is made in the nasal bone 36 through which the lower end portion 26 of the replacement tube 20 is inserted for communication with the inferior nasal meatus 34. As part of the dacryocystorhinostomy, a new and larger opening or "punctum" is made at the innercanthus for the lacrimal fluid to drain into the upper opening 42 of the replacement tube 20.

The lacrimal fluid from the lacrimal gland 44 enters the conjunctival sac of the eye through the upper lacrimal duct 46, washes across the sclera 48 and enters the opening or artificially constructed punctum at the innercanthus. Thence, the lacrimal fluid flows through the replacement tube 20 and into the nasal passage 34. Quite often, despite surgical precautions, the patients flesh heals over the inlet 42 of the replacement tube 20 thereby sealing off the surgically constructed "punctum."

Healing over of the surgically constructed drain outlet in the innercanthus can be prevented by the modification of my replacement tube 20's shown in FIG. 2. A length of string, nylon filament, or other flexible cord 50 is inserted through the replacement tube 20'. The string 50 protrudes a short distance from the upper end 42' of the replacement tube 20'. The other end of the string can be secured to a stopper or closure 52, or otherwise to the lower end of the tube 20', to prevent loss of the string 50 during handling of the replacement tube 20', by inserting the stopper 52 or other suitable retaining means into or onto lower end 54 of the replacement tube 20'. Immediately following implantation of the replacement tube 20' in the incision, the upper or free end of the string or cord 50 can be taped to the facial area 56 adjacent the patient's eye.

When the incision has healed sufficiently, it is desirable to remove the cord 50 and closure 52. This can be accomplished by insertion of a suitable surgical instrument upwardly through the nasal passage to the point where the lower end 54 of the replacement tube projects slightly through the septum and into the inferior nasal meatus (FIG. 1B). The closure 52 or other retaining means then can be grasped and removed while pulling with it the cord 50. The upper end portion of the string 50 passes through the innercanthus leaving the necessary and fully healed drain opening or constructed punctum for the lacrimal fluid to enter the upper end 42' of the replacement tube 20'.

In accordance with the FIG. 3 modification of my invention, the string or filament 50' can be removed from the replacement tube 20' without the use of surgical instruments, after the dacryocystorhinostomy. In this arrangement of the invention a lower end portion 58 of the string or cord 50' projects from the lower end 54' of the replacement tube 20' a sufficient distance to be extended through the nasal passage and taped (reference numeral 60) to the upper lip or adjacent facial surface of the patient. The upper end portion of the string or filament 50' is taped as aforesaid at 56. Before implantation of the replacement tube 20' the lower portion 58 of the string or filament 50' is first inserted through the surgically made nasal opening 40' where it is grasp by another surgical instrument and pulled downwardly through the nasal passage as shown in FIG. 3. Following this operation, the replacement tube 20' is then placed in the incision as described previously.

When the incision has healed sufficiently, the sections of tape 56, 60 are removed and the lower cord portion 58 is grasped to withdraw the string or cord 50' from the reconstructed lacrimal drain opening or "punctum" and from the replacement tube 20' by pulling the string or filament 50' downwardly through the nasal passage.

As shown in FIGS. 1B and 3, the replacement tube desirably is angled inferiorly and medially to ensure proper drainage.

For patients having closely spaced eyes, or relatively small features, or other physical conditions dictating the use of a non-linear replacement tube, such as one of the tubes described previously, it is contemplated that one or both of the end portions of the replacement tube can be curved. It is preferable however to curve only the upward end portion of the replacement tube, whenever possible, as use of a relatively straight lower end portion facilitates insertion thru the opening made in the nasal bone. For example, as shown in FIG. 4 replacement tube 62 is provided with a relatively straight lower end portion 64 and a curving or bent upper end portion 66 separated, of course, by a retaining protuberance or expanded section 68. The lower end portion 66 of the replacement tube desirably is straight for more direct or medial insertion through the opening made in the nasal bone. In FIG. 6 the upper end portion 66", of the replacement tube 62" is likewise curved. In accordance with the modification of FIG. 5, both of the end portions of the replacement tube 62" can be curved or bent, either as shown, or in
accordance with some other desired configuration depending upon specific physical features of the patient.

The replacement tube 62' of FIG. 6 illustrates a further feature of my invention. A protuberance or expanded portion 70 thereof is provided with a relatively smaller transverse dimension for relatively closely fitted insertion within the nasal bone opening 40'. During healing, the bone tissues commence to fill the opening 40' and form around the protuberance 70 to entrap the replacement tube 62' against rejection thereof. As in the case of the protuberance shown in FIG. 1 at reference numeral 22 and in other figures, the external shape can be varied, within the teachings of the present invention, and as noted hereinafter. In most cases, the protuberance 70 can be made relatively smaller than the protuberance shown in FIG. 1 or similar protuberances of other figures.

The cord 50 of FIG. 2 or the cord 50' of FIG. 3 can be utilized of course with any modification of the invention as illustrated herein or a contemplated thereby. By the term "cord," I include any elongated flexible member, such as a wire or string, suitable for this purpose. In the FIG. 2 modification, the upper end portion 24' can be flanged at 71 to facilitate collection of the lacrimal fluid in the innercanthus.

The remaining Figures of the drawings are directed to exemplary shapes of the retention protuberance or expanded portion of the replacement tube which likewise can be substituted in any of the preceding figures. Obviously, other shapes of protuberances can be substituted within the teachings of the present invention.

In FIGS. 7 and 7A of the drawings, a molded replacement tube 80 is shown with a pair of relatively flat protuberances 82 molded integrally with the tube 80. In this arrangement, two such protuberances 82 extend opposite from the mid-portions of the replacement tube 80. A drain passage 84 extends continuously through the replacement tube 80. The passage 84 can be of constant diameter so that there is no retention of lacrimal fluid at any time within the replacement tube. As evident from FIG. 7B a larger number of the protuberances 82 can be utilized if desired and spaced around the circumference of the drain tube 80'.

Still other shapes of protuberances are shown in FIGS. 8, 8B. In FIG. 8A protuberance 86 of the replacement tube 88 is of discoidal configuration and extends transversely of the drain tube 88. End portions 90, 92 of the replacement tube 88 are joined to the mid sections of the protuberance 86. In the replacement tube 88' of FIG. 9B, one side 94 of a discoidal projection 96 can be faced in the more likely direction in which the replacement tube 88' would otherwise be rejected.

The method aspect of my invention will now be described with reference to FIG. 9. As noted above, the replacement tube 20a is surgically implanted in the canthal area 100 of the patient ancillary to the dacrocyosthorinostomy. In performing the operation, an arcuate incision 102 is made commencing about 3mm above and nasal to the medial canthus. Thence the incision 102 proceeds downwardly and outwardly for a distance of 1.5 to 2.0cm. The edges of the incision 102 are spread (not shown) to permit removal of the canaliculi 104, lacrimal sac 106 and the nasolacrimal duct 108. The nasal bone 110 is perforated at 40a by means of hammer and chisel or with a mechanically driven trephine.

The replacement tube 20a is then positioned as shown in FIG. 9, with its upper end 112 adjacent to the inner-canthus and with its lower end 114 just protruding through the lacrimal bone 110, periostuem 116 and nasal mucosa 118 for communication with the inferior nasal meatus. This ensures direct drainage of lacrimal fluid from the innercanthus 122 directly to the nasal meatus 120 through the replacement tube 20a. The tube 20a by-passes the natural excretory lacrimal apparatus which is, of course, removed as part of the dacrocyosthorinostomy. After the replacement tube 20a is thus positioned in the incision 102 the medial canthal ligament 129, which was cut with the incision 102, is then sutured and the incision 102 is closed in the normal manner.

As noted previously, the replacement tube 20a can be provided with a string 124 extending therethrough and protruding at least from the upper end 112 of the replacement tube 20a. In the illustrated case the string or cord 124 protrudes from both ends of the tube 20a, and the upper end portion of the cord is taped at 126 where it emerges from the innercanthal area of the eye 122. The lower end portion of the string 124 is inserted through the inferior nasal meatus 120 and is taped at 128.

The upper end portion of the cord 124 prevents the patient's flesh from healing completely over the upper end 112 of the replacement tube 20a. As another feature of my method, then, the cord 124 preserves the surgically reconstructed opening or punctum 130, as it were, to provide a drain inlet through the thin layer of the patient's flesh which remains over the upper end of the replacement tube. As noted previously, in prior procedures, it has been extremely difficult to prevent the patient's flesh from healing completely over the upper end of the replacement tube and closing off its inlet.

The lower end portion of the cord 124, which can be omitted in favor of the FIG. 2 arrangement, if desired, provides convenient means for withdrawing the cord 124 after the incision has healed sufficiently. At that time the segments of tape 126, 128 were removed and the cord 120 simply is pulled downwardly through and from the tube 20a and the punctum 130. A presence of the cord 124 during healing of the patient's flesh in the vicinity of the surgically constructed punctum 130 prevents closure of the punctum until the walls of the passage are sufficiently stable. Thereafter the passage is maintained open by the more or less continuous flow of the patient's lacrimal fluid.

From the foregoing it will be apparent that novel and efficient forms of replacement tube for the lacrimal drainage ducts have been described herein. While I have shown and described certain presently preferred embodiments of the invention and have illustrated presently preferred methods of practicing the same it is to be distinctly understood that the invention is not limited thereto but may be otherwise and variously embodied and practiced within the spirit and scope of the invention.

I claim:
1. A full-flow replacement tube for lacrimal drainage ducts and configured for permanent retention in a patient's canthal area, said tube being fabricated from a substantially rigid material and comprising a pair of elongated end portions, an expanded portion having a drain passage extending therethrough longitudinally of said end portions and adjoining adjacent ends respectively of said end portions, each of said end portions having a drain passage extending therethrough and communicating with the drain passage of said expanded portion, said expanded portion forming abrupt outer junctions at generally opposite sides thereof with said end portions respectively to prevent rejection of said replacement tube through the patient's flesh in either direction longitudinally of said end portions, and inner wall surfaces of said expanded portion forming relatively smooth junctions with inner wall surfaces of said end portions respectively in avoidance of obstruction to a full-flow of lacrimal fluid therethrough, said end portions and said expanded portion being shaped to extend from an innercanthus to an inferior nasal meatus of a given patient and to drain lacrimal fluid through said drain passages by gravity at least in an erect posture of said patient, at least one of said end portions having a sufficiently small outer dimension so as to extend through a surgical perforation in the patient's lacrimal bone, said expanded portions having an outer dimension of a size to prevent passage thereof through said perforation.

2. The combination according to claim 1 wherein said end portions are substantially straight and in substantial alignment with one another.

3. The combination according to claim 1 wherein said end portions are each of substantially constant diameter.

4. The combination according to claim 1 wherein at least one of said end portions is of bent or curving configuration.

5. The combination according to claim 1 wherein said expanded portion includes a number of individual and laterally extending protruberances.

6. A replacement tube for the lacrimal drainage ducts, said tube comprising a pair of elongated end portions, an expanded portion having a drain passage therethrough and adjoining adjacent ends respectively of said end portions, each of said end portions having a drain passage extending therethrough and communicating with the drain passage of said expanded portion, said expanded portion forming relatively abrupt junctions at generally opposite sides thereof with said end portions respectively to prevent rejection of said replacement tube in either direction of said end portions, and a relatively flexible cord inserted into said tube and extending from the upper end portion thereof when implanted in a patient to prevent the innercanthal area of the patient from healing over an inlet opening of said tube.

7. The combination according to claim 6 wherein said cord extends substantially through said tube and is secured at the other end thereof to an inserted stopper or closure.

8. The combination according to claim 6 wherein said cord extends entirely through said tube and protrudes from a lower end thereof when so implanted to permit grasping and pulling of the cord downwardly through said tube.

9. The combination according to claim 8 wherein said cord extends a sufficient distance outwardly from the upper end of said tube for overlapping to an adjacent facial area of the patient and the lower end portion of the cord extending outwardly of the tube sufficient distance to pass through the inferior nasal meatus for taping to an adjacent facial area of the patient.

10. The combination according to claim 1 wherein said tube is fabricated from a glass material and said expanded portion is blown spheroidal bubble.

11. A method for surgically by-passing the lacrimal drainage ducts, said method comprising the steps of surgically removing said ducts, constructing a passage in the canthal area of a patient substantially from the innercanthus to the inferior nasal meatus, said passage including a perforation through the lacrimal bone, inserting a cord through a replacement tube for said ducts, inserting said tube and cord in said passage, and extending an upper portion of said cord through the inner-canthal area of the patient's eye so that the patient's flesh can heal therearound to form an excretory inlet to said tube.

12. The method according to claim 11 including the additional step of extending a lower end portion of said cord through the patient's nasal passage for grasping and removing the cord from said tube and said inner-canthal area after healing of the incision.

13. The method according to claim 11 including the additional step of enlarging an intermediate portion of said tube for retentional purposes prior to insertion thereof in said incision.

14. A method for surgically by-passing the lacrimal drainage ducts, said method comprising the steps of surgically removing said ducts, constructing a passage in the canthal area of a patient substantially from the innercanthus to the inferior nasal meatus, said passage including a surgical perforation through the lacrimal bone, forming a relatively rigid drainage tube substantially in conformance with said passage to extend substantially from the patient's innercanthus to the inferior nasal meatus, disposing both said passage and said drainage tube such that lacrimal fluid drains through said tube by gravity at least in an erect posture of the patient, enlarging an intermediate portion of said tube for retentional purposes, and implanting said tube in said passage.

15. Replacement means for the lacrimal drainage ducts, said replacement means comprising a relatively rigid tubular member having a length sufficient to extend from the canthal area to the inferior nasal meatus of a patient, said tubular member having a full-flow drainage passage extending therethrough, a flexible cord inserted into said tubular member and extending substantially therethrough, said cord in addition extending from an upper end portion of said tubular member when implanted in said patient to prevent the innercanthal area of the patient from healing over an inlet opening of said tubular member.

16. The combination according to claim 15 wherein said cord extends at least to a lower end portion of said tubular member, and secure means are secured both to said cord and to said tubular member lower end portion such that said secure means and said cord can be removed with a surgical instrument inserted into the nasal passage of said patient.
17. The combination according to claim 15 wherein said cord in addition protrudes from a lower end of said tubular member for extension through a nasal passage of said patient for removal purposes.

18. The method according to claim 14 including the additional step of providing means extending from an upper end of the tube and through the innercanthal area of the patient's eye to prevent tissue closing off the upper end of said tube.

19. Replacement means for the lacrimal drainage ducts, said replacement means comprising a relatively rigid tubular member having a length sufficient to extend from a canthal area to an inferior nasal meatus of a patient, said tubular member having a full-flow drainage passage extending therethrough, and means attached to said tubular member and extending at least from one end thereof to prevent the innercanthal area of the patient from healing over an inlet opening of the tubular member.

20. The combination according to claim 19 wherein said tubular member has an intermediate expanded portion through which said drainage passage extends, said expanded portion forming abrupt outer junctions with the remainder of said tubular member to prevent rejection thereof in either direction longitudinally of said member.

* * * * *