ADDITIONAL REMARKS ON THE
USE OF CAOUTCHOUC THREAD
FOR SUTURES,

AND OTHER PURPOSES IN SURGERY.

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SINCE the communication in *THE LANCET* of March 13, 1841, on the use of caoutchouc threads for sutures, I have made some experiments upon the material which I think are of sufficient importance to deserve being made known to those who may feel disposed to try it, in order that they may not be disappointed, and thus be led to abandon what I have reason to think will, if fairly tried, be found in many cases to possess considerable advantages over the ordinary silk or thread sutures.

The first caoutchouc ligatures which I used were obtained, as I then stated, by removing the fibrous envelope from the Indian-rubber base, as found in the elastic web now so commonly employed. I have since obtained a supply of the caoutchouc thread alone, for which I am indebted to the politeness of Mr. Simpson, surgical instrument-maker, of the Strand. In this state, as manufactured at ordinary temperatures, the thread is firm, but little elastic, and unfit to be used as sutures, since it possesses but in a low degree the properties which chiefly recommend it; and, moreover, by the application of heat it contracts to so great a degree, that if introduced into the integuments in this state it would probably soon cut its way out, or at any rate induce so much constriction as to be highly injurious.

The thickness of the thread which I should recommend for ordinary sutures is about the one-sixtieth of an inch in diameter when cold. This, on the application of the warmth of the hand, speedily contracts to *one-sixth* of its previous length, and becomes highly elastic. When cold it retains its shortened and elastic condition for any length of time, but it readily admits of being stretched to somewhat more than its original extent, by winding it tightly round any solid body, and allowing it to remain upon it for some time; if the temperature be below 80° F. it will then continue elongated, but if above this point, on the extending force being removed, it immediately contracts again.

In order to determine with more accuracy the extent of the contraction of the caoutchouc thread, the degree of heat at which this takes place, and in what circumstances the disposition to contraction and consequent elasticity is equably maintained, I performed the following experiments:—A piece of the thread, nine feet long, and of about the one-sixtieth of an inch in diameter, drawn through the mouth, held in the closed hand, or before

the fire, immediately contracted to eighteen inches, or one-sixth of its original length. On being forcibly stretched out it measured eleven feet, but on the extending force being removed again contracted to eighteen inches. On placing a portion of the same length in water at 80° F. no change in it took place; at a temperature of 85° F. it slowly and irregularly contracted in knots to four feet eight inches, which length it retained when taken out and cold. If the water was 90° F. the thread instantly and uniformly contracted to eighteen inches, and whatever be the increase of the temperature up to 212° F., no farther shortening took place. In a dry heat the effect is the same, only not manifested quite so rapidly, and at first I was inclined to think two or three degrees higher temperature were required, but I am now satisfied that this is not so, and that it is dependant upon the caloric being less readily communicated by the air than by water. When the thread is thicker than the sixtieth of an inch, the contraction does not amount to five-sixths of its entire length, perhaps to the four-fifths or three-fourths, but in other respects the effects are the same. All retain their respective lengths when cold, and all maintain the elastic property when warm. Thus, if a piece be wound tightly round the finger, it continues to impress it with an equal degree of force. Hence before the suture be introduced, I should recommend that thread be immersed in warm water of *not less* than 90° F.; by this, ligatures, which possess an uniform degree of elasticity, are always obtained, and the surgeon can readily estimate how tight he should draw the ligature in tying it. In doing this, he should bear in mind the nature of the injury, the density of the part affected, and its present condition, by which he ought to regulate the degree of tension which he gives to the suture; thus, if he expect much swelling he should only draw it so tight, as in the first instance to merely maintain the parts in apposition; if, on the contrary, there already be much swelling, he would draw it rather tighter in anticipation of the subsidence of the tumefaction. But so elastic is the contracted thread, that I apprehend it is *much more* to be feared that the tension given will be too great than not sufficient, and would suggest attention to this point; because if it be, the great object in the use of these sutures is not obtained, and they will cut their way out as soon as the fibrous unelastic ligatures, as I have recently witnessed: when, however, this is attended to, the threads will remain for many days without producing any irritation. In a case where a large tumour had been removed, and where four of the caoutchouc threads were introduced, at the expiration of a week there was no ulceration about the sutures, which were only then removed because the wound had united.

In *THE LANCET* for March 13th, 1841, to which I refer for a statement of the advan-

tages which I think the caoutchouc ligatures possess over those made of any fibrous material, I mentioned that previous to being introduced the threads should be smeared with a little oil; this I find to be unnecessary, as it passes perfectly well without, and its employment renders the knot more liable to slip than if not used.

As in the contracted state in which the thread is introduced it is considerably thicker than when stretched out, or than the ordinary ligatures, it appears somewhat bulky when passed through the needle eye: in consequence, however, of its elasticity, it does not form nor require so large an aperture as would *à priori* be supposed. Should this be thought an inconvenience, it may easily be obviated, by using a needle in which a greater proportion of the blunt end is filed away so as to leave but a small bar at the eye; or by using a needle made with a split instead of an eye, into which the thread is put, in the same manner as is practised with some seton-needles. Mr. Simpson has just made me some needles of this latter description, which are very well adapted for the purpose. I would recommend that the thread should not be cut into lengths for each suture, but that one should be introduced, and then the others from the same thread; if this be not done, much of the material will necessarily be wasted, on account of its elasticity. I would also further suggest, that the thread should be kept in its concentrated state; for although it maintains its elastic condition, and appears unchanged for some weeks, yet I am inclined to think, after the lapse of several months, its tenacity is not quite equal to that which it possesses just after it has been made to contract; and as the contraction is the work of only a minute, and merely requires the thread to be held in the hand or placed in warm water, there can be no difficulty in always having freshly-contracted ligatures.

Another purpose for which I think the caoutchouc thread appears to be well adapted, is the dressing of wounds where adhesive plaster cannot be retained. There are some persons whose skin is so irritable, that adhesive plaster of any kind always produces inflammation; and there are many contused and lacerated wounds, where it is highly desirable to bring the gaping surfaces in contact, and also to produce some degree of pressure upon the detached or torn parts; while, at the same time, fomentations and poultices, or cold lotions, are necessary. In these cases plaster cannot retain its hold, as by the moisture its adhesive properties are destroyed. I propose, when the injured part admits of it, and in the majority of cases it does, as nine out of every ten of these are accidents to some part of the extremities, to bind it up by encircling it with a portion, longer or shorter as may be required, of the caoutchouc thread. By this any degree of pressure and co-aptation may be obtained, and at the same time neither su-

tures nor plaster are required, while apertures are left for the free discharge of matter, should it form, and the warm application comes in direct contact with the injured part; or should cold lotions be used, it is easy to interpose between the wound and the thread-like bandage a piece of gold-beater's skin or lint, and thus completely exclude the air from the raw surface: an advantage which, I believe, to be of more importance than, perhaps, some surgeons imagine.

Before concluding, I may allude to a very different class of affections, in which it appears probable that this elastic material, applied as a bandage, might be used with advantage; as yet I have not had an opportunity of putting the idea to the test, but think the proposition so reasonable, that I shall do so the first time a suitable opportunity presents itself,—I mean in cases of strangulated hernia, when reduction cannot readily be effected, but particularly those which are large and of long standing, where, also, the ring is of considerable size; and the difficulty arises rather from the increase and incarceration of the contents of the sac, than from compression by a narrow ring. In these cases inflammation rarely occurs very high; but when it does, it is apt to be of that diffuse character which is the most to be feared after operations. In the cases of which I speak, well-regulated pressure will generally be successful in effecting the reduction, and I know of no means by which it can be more directly, gradually, and equally applied; yet, at the same time, without violence or forcible kneading of the hernia, than by surrounding the whole tumour with a long string of caoutchouc thread: of course the application should commence from the bottom of the hernia, and pass, uninterruptedly, up to the neck. For this purpose I should recommend a thread of about double the thickness of that proper for sutures; or what would be still better, the material in the form of a narrow tape which, wound spirally round, would completely encase the rupture. By this a degree of pressure, quite as great as it is prudent to employ, may be obtained; for I am by no means certain that I have not witnessed several cases where the death of the patient ought not much rather to be attributed to the injury inflicted upon the gut and peritoneum by the repeated and forcible squeezings to which it is very often subjected, in the anxious efforts to effect a reduction of the hernia by the taxis, than to any other cause. Now, it seems reasonable to suppose that some portion, frequently gaseous, of the contents of the sac may be expelled by the long-continued and powerful, because elastic, pressure of the caoutchouc as now recommended, especially as all other means and applications may be enjoined. It may be well to state, that the thread may be procured of Mr. Simpson, 55, Strand, London.