# POCKET GUIDE

## SUTURE MATERIALS
## TECHNIQUES & KNOTS

SERAG WIESSNER

# POCKET GUIDE TO SUTURE MATERIALS

Suture materials are very closely related to surgery and have been throughout its history. Even with the introduction of alternative methods of wound closure such as strips and clips, suture materials are still of paramount importance. It is no exaggeration to claim that hardly any surgical procedure is performed without the use of suture material.

This booklet makes no claim to be an exhaustive review of the subject. As its title implies, it is intended as a handy and uncluttered guide for those working with surgical suture materials. As such, it has been deliberately designed to fit into any pocket.

Our guide to suture material is intended to provide the basis for a more detailed study of the subject and we hope that you find it useful. We are, of course, always grateful for any comments and suggestions.

Sincerely
SERAG-WIESSNER KG – Naila, Germany

5th. revised edition


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# COMPANY

As the oldest German manufacturer of surgical suture material, SERAG-WIESSNER combines decades of experience with the most up-to-date medical expertise. The manufacture of sterile catgut was started over a hundred years ago. The company is also a long-established, successful manufacturer of sterile liquid medical preparations. At the manufacturing plant in Upper Franconia, productive efficiency has both a tradition and a future: through a combination of skilled manual work and high-tech, industrial production methods, it is possible to manufacture ultra-small batches, customised items and standard products to the highest quality requirements. In a clean-room area of 2,000 $m^2$, textile implants, surgical suture material, infusion and irrigation solutions are manufactured according to the latest standards from research and technology. In addition, interdisciplinary teams of external and in-house physicians, pharmacists, biologists, chemists and engineers are developing new, improved and better tolerated materials and novel treatment options.

SERAG-WIESSNER is an owner-managed, independent, medium-sized family company. Our successful company history goes back almost 150 years.
Our decisions and developments are characterised by continuity and long-term forward thinking. This has resulted not only in relationships with customers and suppliers going back decades but also in the development of new spheres of business activity. The 200 highly qualified and experienced employees at our site in Naila, Northern Bavaria, have played a decisive role in this success story.

For further information about our company, please request our company brochure.

# HISTORY

The technique of closing wounds by means of needle and thread is several thousand years old. The history of surgical sutures can be traced back to ancient Egypt, and the literature of the classical period contains a number of descriptions of surgical techniques involving sutures.

Before catgut became the standard surgical suture material towards the end of the 19th century, many different paths had been followed to find a suitable material for sutures and ligatures. Materials that had been tried included gold, silver and steel wire, silk, linen, hemp, flax, tree bark, animal and human hair, bowstrings, and gut strings from sheep and goats.

At the beginning of the 19th century metal threads were tested as suture material. At that time inertness of a material with respect to body tissues was considered an advantage. Nevertheless, metal threads had major disadvantages: their stiffness rendered knottying more difficult and could easily result in knot breakage; in addition, suppuration of the wound edges occurred frequently.

These negative experiences with metal contributed to the establishment of silk as the number one suture material. Wounds sewn with silk cicatrized within a few days, and the small knot caused no problems. For these reasons most surgeons at that time chose silk for sutures and vessel ligatures. A fundamental change in the assessment of suture materials followed the publication in 1867 of Lister's research on the prevention of wound suppuration. On the basis of work by Koch and Pasteur, Lister concluded that wound suppuration could be prevented by disinfecting sutures, dressings, and instruments with carbolic acid. Initially Lister used silk as a suture material, on the assumption that it was absorbable and therefore could also be used for ligatures. Later he searched for a more rapidly absorbable material and consequently began to use catgut.

Catgut is produced from animal connective tissue, in particular bovine subserosa. Over the years it gradually emerged that animals born and bred in South America were most suitable because they had the lowest fat content thanks to their natural husbandry conditions.

The use of catgut was never called into question until the appearance of BSE at the beginning of the 21st century. Alternative products had already been developed by this time.
These are the synthetically manufactured absorbable suture materials which have largely superseded catgut in Europe. However, catgut continues to play a major role in woundcare world-wide.

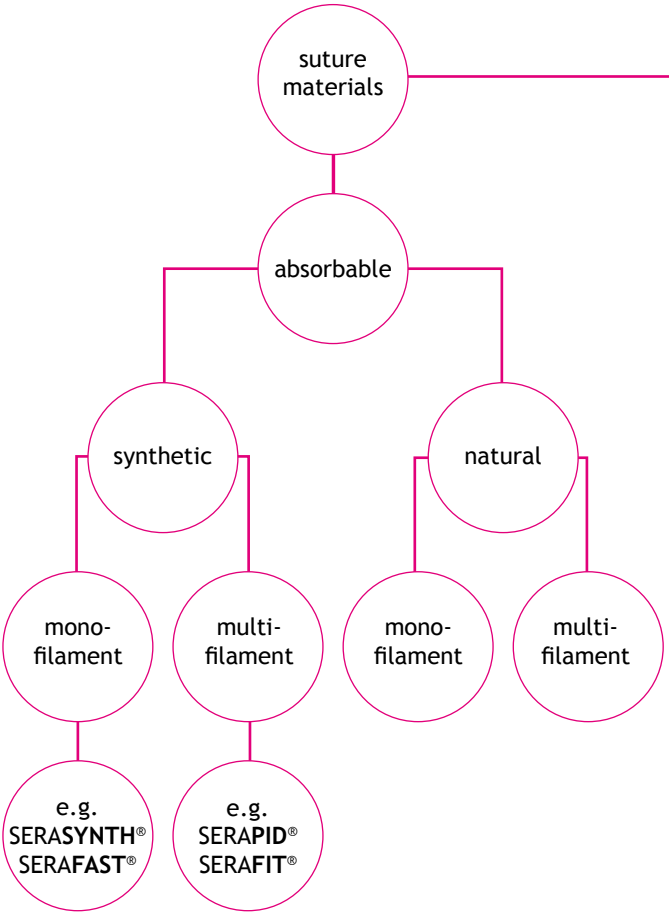
A wide variety of sterilization methods have been tested at various times. Nowadays sutures are mostly sterilized by ethylene oxide or gamma irradiation.

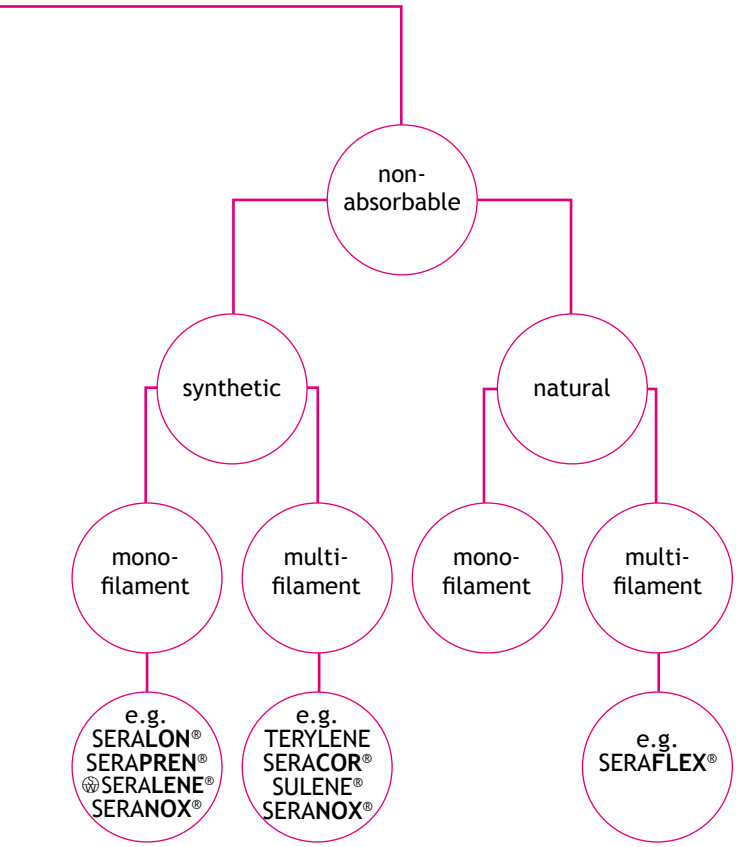
In response to the requirements of modern surgery and thanks to the efforts of users and manufacturers over the last few decades, a wide variety of sutures have now been developed.

# SUTURES

# CLASSIFICATION OF MATERIAL

Surgical suture material can be classified on the basis of the characteristics absorbability, origin of material and thread structure. This is illustrated by the following diagram.




non-absorbable
synthetic
natural
mono-filament
multi-filament
mono-filament
multi-filament
e.g. SERALON® SERAPREN® SERALENE® SERANOX®
e.g. TERYLENE SERACOR® SULENE® SERANOX®
e.g. SERAFLEX®

# ABSORBABILITY

An important differentiating characteristic of suture material is its absorbability in human tissue. Suture material can be classified as absorbable or nonabsorbable.

Absorption can occur enzymatically, as with catgut, or hydrolytically, as with the absorbable synthetic polymers. An important measure of absorbability is the absorption time or halflife, which is defined as the time required for the tensile strength of a material to be reduced to half its original value. Dissolution time is the time that elapses before a thread is completely dissolved. These times are influenced by a large number of factors including thread thickness, type of tissue, and, not least, the general condition of the patient.

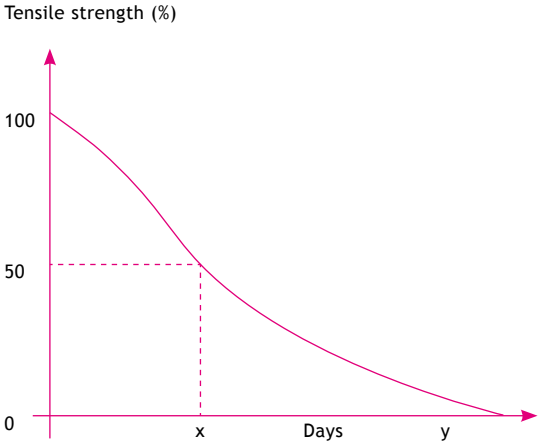
The most important absorption and dissolution times are shown in the following table:

Approximate absorption times
of synthetic suture materials:

| Material | Half-life (days) | Dissolution (days) |
|---|---|---|
| SERA**PID**® | 5–7 | 30–42 |
| SERA**FIT**® | 15–20 | 60–90 |
| SERA**FAST**® | 8–13 | 90–120 |
| SERA**SYNTH**® | 28–42 | 180–210 |

## Absorption

absorbable sutures




x = half-life
Period in which a 50 % loss of tensile strength occurs.

y = dissolution time
Period in which the suture totally dissolves.

## Origin of material

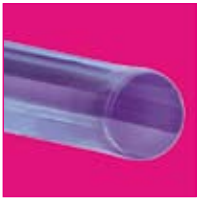
Suture materials can be classified as being of natural or synthetic origin. The former include silk and catgut. The other main group of suture materials are those produced from synthetic polymers such as polyamide, polyolefines and polyesters. This group also includes absorbable polymers derived from polyglycolic acid.

# THREAD STRUCTURE

Monofilament and multifilament thread structures are distinguished.

## Monofilament threads

Synthetic monofilament threads are produced by a special extrusion process in which molten plastic is extruded under high pressure through fine spinnerets. The monofilament structure is used mostly for thinner threads. With thicker threads the wiriness that is a characteristic of all monofilament threads impairs handling and in particular renders knot-tying more difficult.
Because of their smooth, closed surface and completely closed interior, monofilament threads have no capillarity. On the other hand, the ease with which they pass through tissue is unsurpassed.



monofilament

multifilament
with coating

## Multifilament threads

Multifilament threads are composed of many fine individual threads either twisted or braided together. The direction of the twist is generally right-handed. Twisted multifilament threads include e.g. silk threads. All twisted threads show considerable variation in diameter. Their surface is mostly rough. The longitudinal orientation of the individual filaments within the thread results in relatively high capillarity. In braided threads the individual filaments lie more or less obliquely to the longitudinal axis of the thread. This tends to impede the passage of fluid. The capillarity of braided threads is therefore less than that of twisted threads. Multifilament threads have a rough surface that impairs passage through tissue but results in considerably better knotholding security. Multifilament threads are generally coated. The coating smoothes out the irregular surface and thus facilitates passage through tissue without impairing knot-holding security. Coated multifilament threads are less stiff and wiry than monofilament threads. The coating also reduces capillarity.

multifilament, braided

multifilament, braided and coated

multifilament, twisted

# SIZE TABLE

| EP (metric) | USP | Ø in mm |
|---|---|---|
| 0,01 | 12-0 | 0,001-0,004 |
| 0,05 | - | 0,005-0,009 |
| 0,1 | 11-0 | 0,010-0,019 |
| 0,2 | 10-0 | 0,020-0,029 |
| 0,3 | 9-0 | 0,030-0,039 |
| 0,4 | 8-0 | 0,040-0,049 |
| 0,5 | 7-0 | 0,050-0,069 |
| 0,7 | 6-0 | 0,070-0,099 |
| 1 | 5-0 | 0,100-0,149 |
| 1,5 | 4-0 | 0,150-0,199 |
| 2 | 3-0 | 0,200-0,249 |
| 2,5 | - | 0,250-0,299 |
| 3 | 2-0 | 0,300-0,349 |
| 3,5 | 0 | 0,350-0,399 |
| 4 | 1 | 0,400-0,499 |
| 5 | 2 | 0,500-0,599 |
| 6 | 3+4 | 0,600-0,699 |
| 7 | 5 | 0,700-0,799 |
| 8 | 6 | 0,800-0,899 |
| 9 | 7 | 0,900-0,999 |
| 10 | 8 | 1,000-1,099 |
| - | 9 | 1,100-1,199 |
| - | 10 | 1,200-1,299 |

The tensile strength and knot-tying properties of a surgical suture material are determined not only by the starting material and structure, but also by the thickness of the thread. Classification of thread size must therefore be precise. Within the purview of the European Pharmacopoeia (EP), suture size is classified according to a decimal system. This denotes the diameter of the suture as a multiple of 0.1 mm.

Unlike the earlier DAB 6 and USP codes, the new metric code is directly related to the actual diameter of the suture (e.g. EP 3 = 3 x 0.1 mm = 0.3 mm). As the USP system is still commonly used, it is shown in the above table for comparison.

# SUTURE MATERIAL SYMBOLS

In accordance with recommendations and in co-operation with the Association of European Suture Material Manufacturers, we use the following symbols to identify the properties of our suture materials:

## Absorbable suture material

Surgical suture, absorbable, braided, coated, dyed e.g SERA**FIT**® violet

Surgical suture, absorbable, monofilament, dyed e.g. SERA**SYNTH**® violet, SERA**FAST**® violet

Surgical suture, absorbable, braided coated, undyed e.g. SERA**FIT**® undyed, SERA**PID**® undyed

Surgical suture, absorbable, monofilament, undyed e.g. SERA**FAST**® undyed

## Non-absorbable suture material


Surgical suture, non-absorbable, braided, coated, dyed e.g. TERYLENE und SULENE® green, SERA**COR**® green, SERA**FLEX**® black


Surgical suture, non-absorbable, braided, dyed


Surgical suture, non-absorbable, twisted, coated, dyed, e.g. SUPRAMID black (USP 4/0 and stronger)


Surgical suture, non-absorbable, monofilament, dyed e.g. SERA**PREN**® and SERA**LENE**® blue, SERA**LON**® blue, NYLON black, SUPRAMID black (USP 5/0 and finer)


Surgical suture, non-absorbable, monofilament, coated, dyed


Surgical suture, non-absorbable, braided, coated, undyed e.g. TERYLENE, SERA**COR**® und SERA**FLEX**® undyed


Surgical suture, non-absorbable, braided, undyed e.g. POLYESTERTAPE


Surgical suture, non-absorbable, twisted, coated, undyed e.g. SUPRAMID undyed (USP 4/0 and stronger), SERA**NOX**® multifilament


Surgical suture, non-absorbable, twisted, undyed e.g. SERA**NOX**® multifilament


Surgical suture, non-absorbable, monofilament, undyed e.g. SERA**LON**® undyed, SERA**NOX**® monofilament, SUPRAMID undyed (USP 5/0 and finer)

# Suture Material-Symbols

## Needles

AR ANTI-REFLECTIVE NEEDLE

DN DETACHABLE NEEDLE

## Basic material of the thread

PA POLYAMIDE

PDO POLYDIOXANONE

PET POLYESTER

PGACL POLYGLYCOLIC ACID-CAPROLACTONE

PGA POLYGLYCOLIC ACID

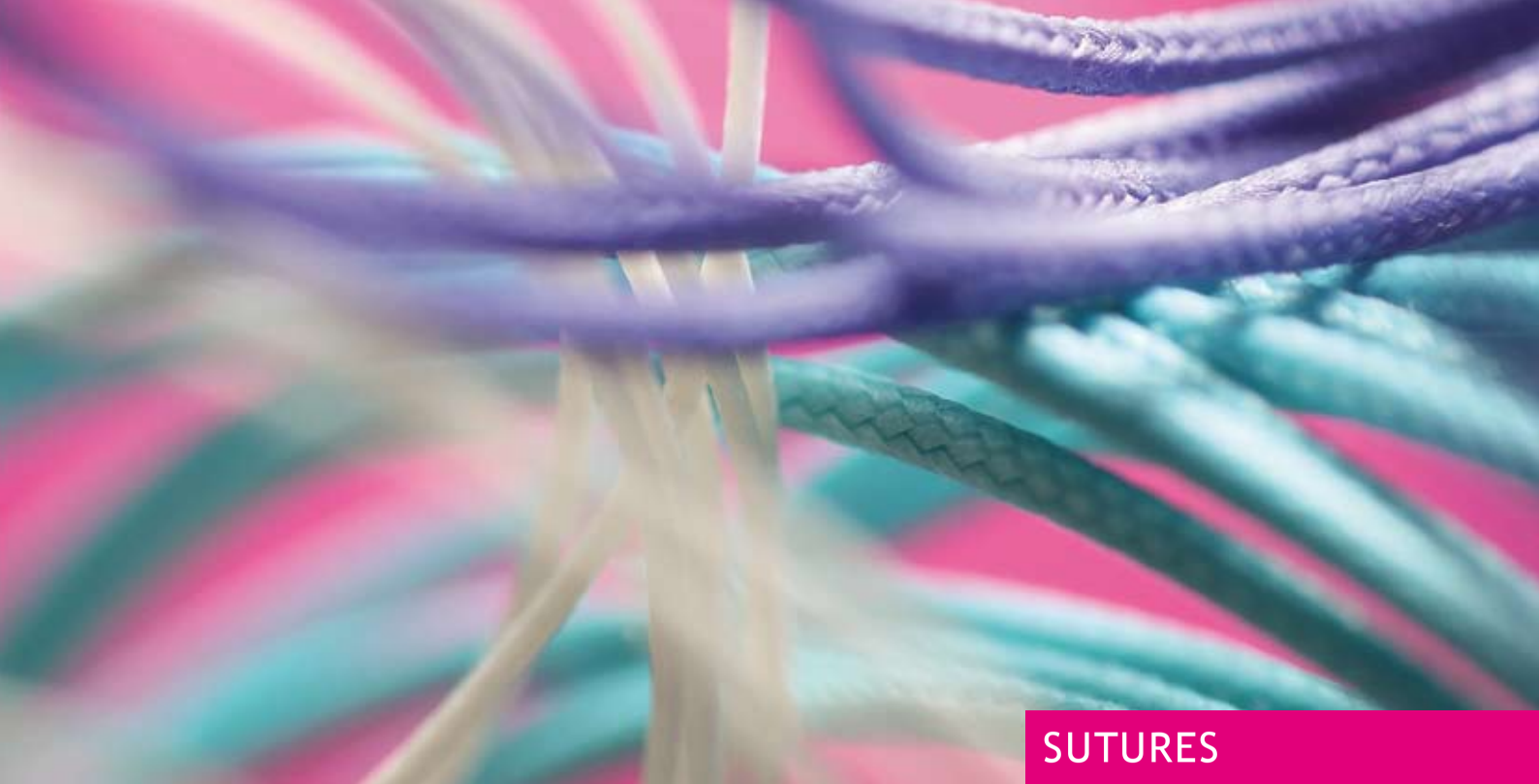
PP POLYPROPYLENE

PVDF POLYVINYLIDENE FLUORIDE

SILK SILK

STEEL STEEL

Further symbols on page 50,
Needle abbreviations are explained on page 41.



# SUTURES

## SERAFIT®

| | |
|---|---|
| **Material** | PGA POLYGLYCOLIC ACID |
| **Symbol** | violet, multifilament (braided),coated<br>or<br>undyed, multifilament (braided), coated |
| **Size** | violet: USP 8/0 to 5<br>EP 0,4 to 7<br>undyed: USP 6/0 to 2<br>EP 0,7 to 5) |
| **Absorption profile** | 50% tensile strength 15-20 days<br>0% after 60-90 days |
| **Available combinations** | |
| Unneedled | Single sutures / multipacks |
| Needled | DR, DRN, DS, DSL, DSS, FRX, GR, GS, HR, HRT, HRX, HS, KS, LR, VSP<br>Single sutures / multipacks<br>Large range of special<br>MIS combinations |
| **Advantages** | good knot stability<br>outstanding suppleness<br>minimal saw effect |
| **Uses** | Ligatures / dermatology / gastroenterology / gynaecology / MIS oral and maxillofacial surgery / ophthalmology / urology / veterinary |



## SERAPID®

| | |
|---|---|
| **Material** | PGA POLYGLYCOLIC ACID |
| **Symbol** | undyed, multifilament (braided), coated |
| **Size** | USP 6/0 to 2<br>EP 0,7 to 5 |
| **Absorption profile** | 50% tensile strength after 5-7 days<br>0% after 42 days |
| **Available combinations** | |
| Unneedled | Multipacks |
| Needled | DS / DSS / FRX / GR / GS / HR / HRT / HRX / HS / KS<br>Single sutures / multipacks |
| **Advantages** | high knot-pull tensile strength<br>easy knot gliding<br>optimal tissue passage |
| **Uses** | ENT / gynaecology /<br>paediatric surgery /<br>oral and maxillofacial surgery /<br>plastic surgery / urology |

## SERA**FAST**®

| | |
|---|---|
| **Material** | PGACL POLYGLYCOLIC ACID CAPROLACTONE |
| **Symbol** | undyed, monofilament<br>or<br>violet, monofilament |
| **Size** | USP 5/0 to 2/0<br>EP 1 to 3 |
| **Absorption profile** | 50% tensile strength after 8-13 days<br>0% after 90-120 days |
| **Available combinations** | |
| Unneedled | Multipacks |
| Needled | DS / DSS / GR / GS / HR<br>Single sutures |
| **Advantages** | unsurpassed handling<br>outstanding tissue sliding ability<br>optimal absorption profile |
| **Uses** | Ligatures / dermatology / plastic surgery / urology / gynaecology / skin closure |



## SERASYNTH®

| | |
|---|---|
| **Material** | PDO POLYDIOXANONE |
| **Symbol** | violet, monofilament |
| **Size** | USP 7/0 to 2<br>EP 0,5 to 5 |
| **Absorption profile** | 50% tensile strength after 28-42 days<br>0% after 180-210 days |
| **Available combinations** | |
| Unneedled | Single sutures / multipacks |
| Needled | DR / DS / DSS / GR / GS / HR<br>HRT / HRX / HS<br>Single sutures / multipacks /<br>special MIS combinations |
| **Advantages** | outstanding sliding ability<br>high linear and knot-pull<br>tensile strength<br>very supple handling<br>reliable absorption behaviour |
| **Uses** | Ligatures / dermatology /<br>vascular surgery / orthopaedics /<br>plastic surgery / urology / MIS |

# SERA**LON**® / NYLON

| | |
|---|---|
| **Material** | PA POLYAMID |
| **Symbol** | undyed (SERA**LON**®), monofilament<br>or<br>blue (SERA**LON**®), black (NYLON) monofilament |
| **Size** | SERA**LON**® blue: USP 7/0 to 3+4 EP 0,5 to 6<br>SERA**LON**® undyed: USP 5/0 to 2/0 EP 1 to 3<br>NYLON: USP 11/0 to 8/0 EP 0,1 to 0,4 |
| **Absorption profile** | non-absorbable |

**Available combinations**

| | |
|---|---|
| Unneedled | Single sutures / multipacks<br>cassette packs |
| Needled | DR / DRM / DRT / DS / DSL / DSS / DSX / GR / GS / HR / HRT / HRX / HS / HSL / KS<br>Single sutures / multipacks |
| **Advantages** | best skin suture material<br>outstanding sliding ability<br>very high linear and knot-pull tensile strength with fine thread<br>very pleasant handling<br>economical large packs |
| **Uses** | Ligatures / general surgery / orthopaedics / plastic surgery |



# SUPRAMID

**Material** PA POLYAMID

**Symbol** undyed, multifilament (twisted, coated)

or

black, multifilament, (twisted, coated)

USP 5/0 and finer: or

**Size**

| | |
|---|---|
| black: | USP 6/0 to 3+4 |
| | EP 0,7 to 6 |
| undyed: | USP 5/0 to 6 |
| | EP 1 to 8 |

**Absorption profile** non-absorbable

**Available combinations**

Unneedled: Single sutures / multipacks cassette packs

Needled: DS / DSS / GS / GR / HR / HRT / HS / VSP
Single sutures / multipacks

**Advantages**
excellent knot stability
outstanding sliding ability
high linear and knot-pull tensile strength
economical large packs

**Uses**
Ligatures / general surgery / oral and maxillofacial surgery / skin closure

# TERYLENE

**Material** PET POLYESTER

**Symbol** undyed, multifilament (braided), coated

or

green, multifilament, (braided), coated

**Size**

green: USP 6/0 to 5
EP 0,7 to 7

undyed: USP 5/0 to 8
EP 1 to 10

**Absorption profile** non-absorbable

**Available combinations**

Unneedled: Single sutures / multipacks
cassette packs

Needled: DR / DRT / DS / DSS / FRX / GR / GS / HR / HRT / HRX / HS / KS / VSP
Single sutures / multipacks

**Advantages**

universal suture material
outstanding sliding ability
very high linear and knot-pull tensile strength
very pleasant handling
economical large packs

**Uses** Ligatures / holding sutures / marking / universal use



# SULENE®

| | |
|---|---|
| **Material** | PET POLYESTER |
| **Symbol** | green, multifilament, (braided), coated |
| **Size** | USP 6/0 to 5<br>EP 0,7 to 7 |
| **Absorption profile** | non-absorbable |

**Available combinations**

| | |
|---|---|
| Unneedled | Single sutures / multipacks<br>cassette packs |
| Needled | DR / DRT / DS / DSS / FRX / GR / GS / HR / HRT / HRX / HS / KS<br>Single sutures / multipacks |
| **Advantages** | universal suture material<br>optimal sliding ability<br>very high linear and knot-pull tensile strength<br>economical large packs |
| **Uses** | Ligatures / holding sutures / marking / MIS / universal use |

## SERACOR®

| | |
|---|---|
| **Material** | PET POLYESTER |
| **Symbol** | undyed, multifilament (braided), coated<br>or<br>green, multifilament, (braided), coated |
| **Size** | green: USP 6/0 to 0<br>EP 0,7 to 3,5<br>undyed: USP 6/0 to 1<br>EP 0,7 to 4 |
| **Absorption profile** | non-absorbable |
| **Available combinations** | |
| Needled | DRT / HR / HRT<br>Single sutures / multipacks<br>with and without pledgets |
| **Advantages** | special suture material for cardiac surgery<br>oval pledgets for simple, secure placement<br>outstanding tissue tolerability |
| **Uses** | Cardiac surgery<br>Special heart valve sutures,<br>also for paediatric cardiac surgery<br>with small pledgets |

## SERA**PREN**®

| | |
|---|---|
| **Material** | PP POLYPROPYLENE |
| **Symbol** | blue, monofilament |
| **Size** | USP 8/0 to 1<br>EP 0,4 to 4 |
| **Absorption profile** | non-absorbable |

**Available combinations**

| | |
|---|---|
| Needled | DR / DRM / DRT / DS / DSL / DSS / HR / HRT / HRX<br>Single sutures / multipacks / long pack / intracutaneous sutures |
| **Advantages** | best results for skin wound closure<br>very high tensile strength<br>high knot stability<br>outstanding tissue tolerability<br>long pack minimises memory effect |
| **Uses** | Ligatures / vascular surgery / microsurgery / orthopaedics / plastic surgery |

## SERALENE®

| | |
|---|---|
| **Material** | PVDF POLYVINYLIDENE FLUORIDE |
| **Symbol** | blue, monofilament |
| **Size** | USP 8/0 to 2<br>EP 0,4 to 5 |
| **Absorption profile** | non-absorbable |

**Available combinations**

| | |
|---|---|
| Needled | DR / DRM / DRT / DRTA / DSS / GR / GS / HR / HRT / HRX / HS / KS<br>Single sutures / multipacks<br>Award-winning long pack |
| **Advantages** | sustained tensile strength<br>high knot stability<br>scarcely any memory effect after stretching<br>best results in vascular surgery |
| **Uses** | Ligatures / vascular surgery / microsurgery / plastic surgery |



# SERAFLEX®

| | |
|---|---|
| **Material** | SILK SILK |
| **Symbol** | undyed, multifilament (braided), coated<br>or<br>black, multifilament, (braided), coated |
| **Size** | black: USP 7/0 to 5<br>EP 0,5 to 7<br>undyed: USP 4/0 to 5<br>EP 1,5 to 7 |
| **Absorption profile** | non-absorbable |

**Available combinations**

| | |
|---|---|
| Unneedled | Single sutures / multipacks / cassette packs |
| Needled | DR / DRT / DS / DSS / DSX / GR /GS / HR / HRT / HRX / HS / HSM / KS / VSP<br>Single sutures / multipacks |
| **Advantages** | high knot stability<br>outstanding sliding ability<br>very pleasant handling<br>economical large packs |
| **Uses** | Ligatures / holding sutures / marking / oral and maxillofacial surgery / ophthalmology |

## SERANOX®

| | |
|---|---|
| **Material** | STEEL STEEL |
| **Symbol** | multifilament, twisted<br>or<br>multifilament, twisted, coated<br>or<br>monofilament |
| **Size** | USP 5/0 to 6<br>EP 1 to 8 |
| **Absorption profile** | non-absorbable |

**Available combinations**

| | |
|---|---|
| Unneedled | Single sutures / multipacks |
| Needled | DS / GR / GS / HRK / HRT / HS<br>Single sutures / multipacks / long packs<br>Special combinations for trauma surgery and cardiac surgery |
| **Advantages** | highest tensile strength<br>various accessories available<br>with special laser attached needles for sternal closure |
| **Uses** | Cardiac surgery (sternum) / orthopaedics / trauma surgery |

# NEEDLES

# STEEL QUALITY FOR NEEDLES

Today it can be assumed that, at least with respect to European manufacturers, stainless steel (i.e. non-corrossive steel) needles are generally used for surgical suture materials.

The following groups of stainless steel are used for the needles:

420 steel: standard quality steel, martensitic, low ductility, low bending strength

455 steel: better 400 quality steel, martensitic, higher ductility, higher bending strength

300 steel: best quality steel, austenitic, highest ductility, highest bending strength, frequently offered exclusively for cardiovascular surgery; used by SERAG-WIESSNER for nearly all suture materials.

Reference values for comparison

| Type of needle | Steel quality | Ductility [illegible] | Ductility [number of 180° movements] | Bending strength [N] |
|---|---|---|---|---|
| HR-22 | 420<br>455<br>300 | 90<br>300<br>700 | 0<br>2<br>4 | 3,5<br>3,8<br>5,4 |
| HR-26 | 420<br>455<br>300 | 80<br>400<br>500 | 0<br>2<br>3 | 4,3<br>5,0<br>6,0 |
| HR-36 | 420<br>455<br>300 | 100<br>400<br>700 | 0<br>2<br>4 | 5,3<br>5,9<br>6,6 |

Comments:
The penetration force of a needle depends in the first line on its shape and the polished and etched microsection of the tip, and less on the quality of the steel
Ductility: how often a needle can be bent back and forth before it breaks
Austenite: microstructure of steel. Austenitic microstructure is face-centred cubic, forms at high temperatures above approx. 1300°C and only remains stable at these temperatures. The addition of alloy components such as nickel and manganese, however, maintains this structure at room temperature.
Martensite: microstructure of steel. Martensitic microstructure forms at high temperatures. It is extremely hard and the structure can be maintained by rapid cooling ("quenching").

# ATRAUMATIC NEEDLES

In addition to the thread, the needle is an essential component of sutures. In the classical procedure, a non-needled suture is fitted with a spring eye or regular eye surgical needle by the user only at the time of use. Nowadays, atraumatic sutures are widely used.

Atraumatic sutures are defined as needle-suture combinations, where the needle is firmly attached to the suture in order to reduce tissue trauma. Combined with our suture threads our customers are offered a wide choice of atraumatic needles.
These stainless steel needles of high bending resistance and outstanding penetration capacity permit a safe and easy work.

## Needle designations

The designations of our atraumatic needles consist of a letter-number combination as per suggestion of the Technical Commitee of the Association of Manufacturers of Surgical Sutures. The first letter indicates the needle shape, the second letter indicates the needle type. If a third or fourth letter follows, these refer to special characteristics of the needle. The number after the letters indicates the overall length of the needle in mm.

## Needle shape

A = fish-hook-shaped
D = 3/8 circle
F = 5/8 circle
G = straight
H = 1/2 circle
K = semi-curved
L = spoon-shaped
V = 1/4 circle

## Needle type

R = round-bodied
S = reverse cutting

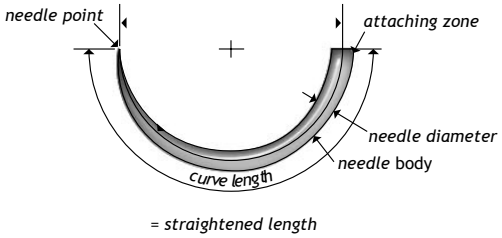
## Special characteristics

A = asymptotic
L = lancet point
N = blunt, round-bodied
SP = spatula needle
X = extra strong
K = short inlying blade
F = slim needle
M = micro point
S = slim
T = trocar needle

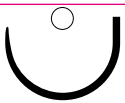
## Examples

DS 18
D 3/8 circle
S reverse cutting
18 18 mm long (straigthened length)

HRX 22
H 1/2 circle
R round-bodied
X extra strong
22 22 mm long (straigthened length)

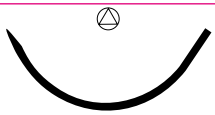


# Needle overview **Atraumatic needles**

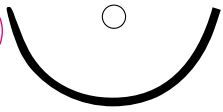
| | | |
|---|---|---|
| **DR** |  | 3/8 circle, round-bodied needle, e.g. DR-20 |
| **DRM** |  | 3/8 circle, round-bodied needle with micro-point, e.g. DRM-6 |
| **DRN** |  | 3/8 circle, round-bodied needle, blunt, e.g. DRN-30 |
| **DRT** |  | 3/8 circle, round-bodied needle with trocar point, (trocar needle), e.g. DRT-17 |
| **DS** |  | 3/8 circle, reverse cutting needle, e.g. DS-15 |
| **DSL** |  | 3/8 circle, reverse cutting needle lancet point, e.g. DSL-6 |
| **DSLA** |  | 3/8 circle, reverse cutting needle lancet point, asymptotic, e.g. DSLA-4 |
| **DSS** |  | 3/8 circle, reverse cutting needle, special point, slim, e.g. DSS-18 |
| **FRN** |  | 5/8 circle, round-bodied needle, blunt, e.g. FRN-27 |
| **FRX** |  | 5/8 circle, round-bodied needle (extra strong needle), e.g. FRX-27 |
| **GR** |  | straight, round-bodied needle, e.g. GR-20 |
| **GS** |  | straight, reverse cutting needle, e.g. GS-25 |

**HR** 

1/2 circle, round-bodied needle, e.g. HR-15

**HRK** 

1/2 circle, round-bodied needle, short inlying blade, e.g. HRK-48 (Pic. not in original size)

**HRN** 

1/2 circle, round-bodied needle, blunt, e.g. HRN-40

**HRT** 

1/2 circle, round-bodied needle with trocar point, (trocar needle), e.g. HRT-20

**HRX** 

1/2 circle, round-bodied needle (extra strong needle), e.g. HRX-17

**HS** 

1/2 circle, reverse cutting needle, e.g. HS-15

**HSL** 

1/2 circle, reverse cutting needle with lancet point, e.g. HSL-5

**HSM** 

1/2 circle, reverse cutting needle with micro-point, e.g. HSM-8

**KS** 

semicurved, reverse cutting needle, e.g. KS-22

**LR** 

spoon-shaped, round-bodied needle, e.g. LR-20

**VSP** 

1/4 circle, spatula needle, e.g. VSP-8

round-bodied needle

round-bodied needle with trocar point

reverse cutting needle

reverse cutting needle, special point, slim

# EYE NEEDLES

Spring eye surgical needles are made of 300-series stainless steel. This generation of needles is characterised by optimum resistance to bending, the best possible ductility and outstanding tissue penetration. This guarantees safe and simple working conditions.

Like our atraumatic needles, our spring eye needles are designated by a letter-number combination. The needle codes thus correspond to those of the atraumatic needles.

# RECOMMENDATIONS

## Recommendations for the selection of suture material

| Field of surgery | Organ/Tissue | Suture material/Product |
|---|---|---|
| General surgery | skin | SERA**LON**®, SERA**FAST**® SERA**LENE**, SUP**RAMID** SERA**PREN**® |
| | vessel ligation, ligature | SERA**FIT**® |
| | fascia | SERA**FIT**®, SERA**FAST**® SERA**SYNTH**® |
| | closure of abdominal wall | SERA**FIT**®, SERA**SYNTH**® |
| Gastro-enterology | stomach and small intestine | SERA**FIT**® SERA**FAST**® |
| | large intestine | SERA**FIT**®, SERA**SYNTH**® |
| | biliary ducts | SERA**FIT**® |
| | peritoneum | SERA**FIT**®, SERA**FAST**® |
| | hernia repair | SERA**PREN**® |
| Cardiac surgery | heart valves | SERA**COR**® |
| | coronary arteries | SERA**PREN**®, SERA**LENE**® |
| Vascular surgery | blood vessels | SERA**PREN**®, SERA**LENE**® |
| Plastic surgery | skin | SERA**LON**®, SERA**PREN**® SERA**LENE**, SU**LENE**®, SUP**RAMID**, SERA**FIT**®, SERA**PID**®, SERA**SYNTH**® |
| | blood vessels | NYLON, SERA**PREN**®, SERA**LENE**® |
| Micro surgery | nerves | SERA**PREN**®, SERA**LENE**® |

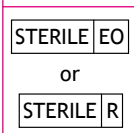
| Size | | Needles |
|---|---|---|
| EP | USP | |
| 1-3 | 5/0-2/0 | DSS, DS |
| 1-3 | 5/0-2/0 | non-needled |
| 1,5-3,5 | 4/0-0 | HS, HR, HRX |
| 3-3,5 | 2/0-0 | HR |
| 1,5-3 | 4/0-2/0 | HR, DR |
| 1,5-2 | 4/0-3/0 | HR |
| 1,5-3 | 4/0-2/0 | HR |
| 1-2 | 5/0-3/0 | HR |
| 2-3 | 3/0-2/0 | HR |
| 1,5-3 | 4/0-2/0 | HR, HRT |
| 0,5-1 | 7/0-5/0 | DR |
| 0,5-2 | 7/0-3/0 | DR, DRM<br>DRT, HR, HRT |
| 0,7-1 | 6/0-5/0 | DSS |
| 0,1-0,4 | 11/0-8/0 | DR, DRM |
| 0,3-1,5 | 9/0-4/0 | DR |

| Field of surgery | Organ/Tissue | Suture material / Product |
|---|---|---|
| Ophthal-mology | | NYLON, SERA**FLEX**® |
| Dental surgery | | SULENE®, SERA**FLEX**® SERA**FIT**®, SUPRAMID® |
| Urology | kidneys | SERA**FIT**®, SERA**SYNTH**® |
| | urinary tracts | SERA**FIT**®, SERA**SYNTH**® SERA**FAST**® |
| | phimoses | SERA**PID**® |
| Thoracic surgery | lungs | SERA**FIT**® |
| | thorax closure | SERA**SYNTH**® SERA**NOX**® |
| Orthopaedics | tendons | SERA**PREN**®, SERA**LON**® SERA**SYNTH**®, SERA**NOX**® |
| | ligaments | SERA**SYNTH**® |
| | semilunar cartilage | SERA**SYNTH**® |
| | bone | SERA**NOX**®, SERA**SYNTH**® BONE WAX |
| Gynaecology | pelvicfloor internal organs | SERAPID®, SERAFIT® SULENE® |
| | mamma | SERAFAST® |

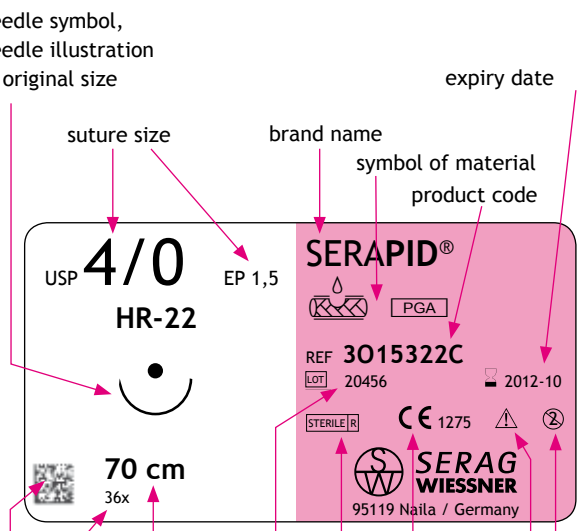
| Size | | Needles |
|---|---|---|
| EP | USP | |
| 0,2-0,4 | 10/0-8/0 | DSL, DSLA, HSL, VSP |
| 1,5-3 | 4/0-2/0 | HS, HR, HRT |
| 2-3,5 | 3/0-0 | HR |
| 1,5-2 | 4/0-3/0 | HR, HRX, FRX |
| 1-2 | 5/0-3/0 | DS, DSS, HS |
| 1,5-3 | 4/0-2/0 | HRT |
| 2-3,5<br>3-8 | 3/0-0<br>2/0-6 | DS<br>HS, HRK, HRT |
| 0,7-3 | 6/0-2/0 | DS, HS, GR |
| 0,7-3 | 6/0-2/0 | DS, HS |
| 2 | 3/0 | DS, HS |
| 3-3,5 | 2/0-0 | GS |
| 3-5 | 2/0-2 | HR, HRX |
| 1-3 | 5/0-2/0 | DS, DSS |

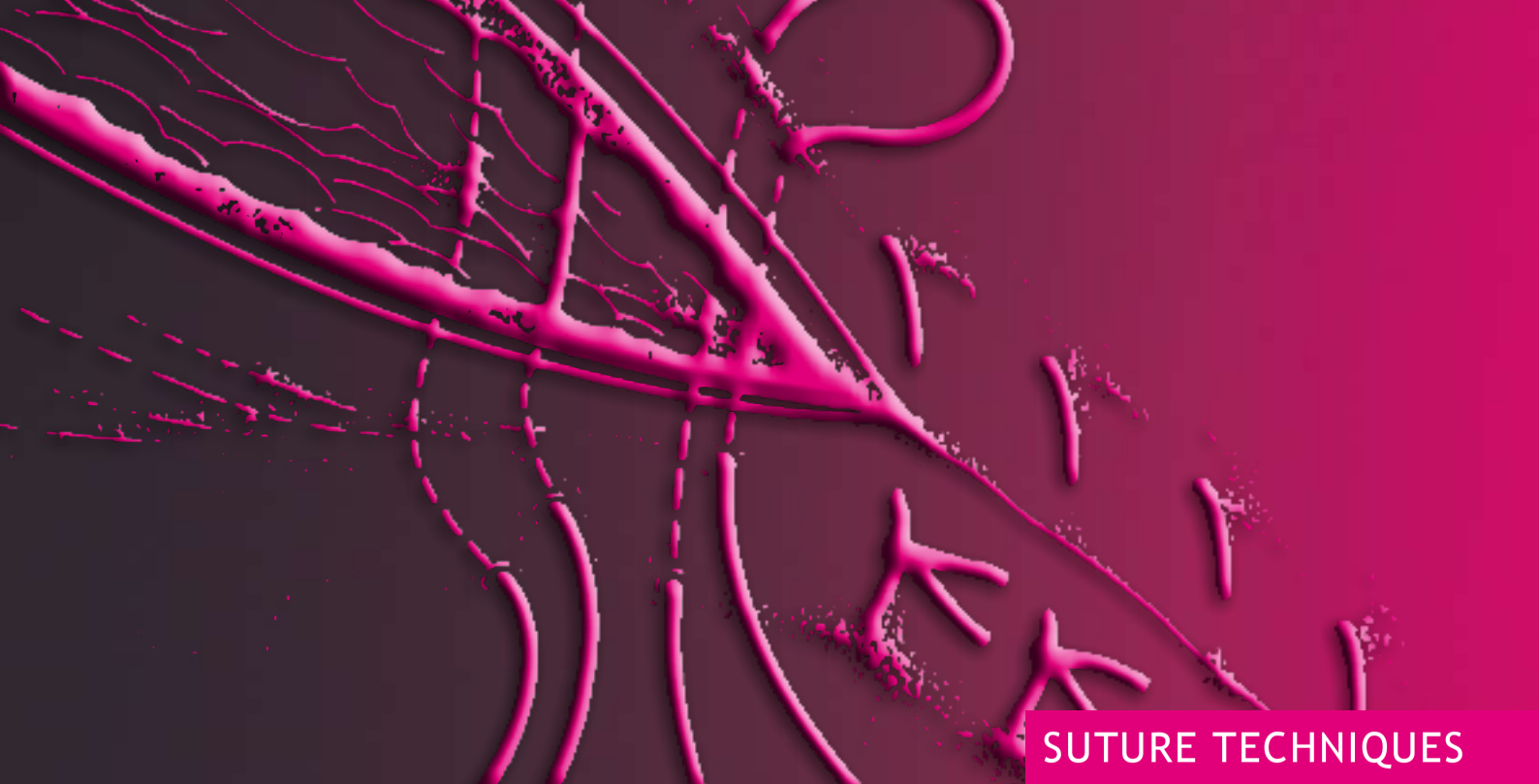
# SYMBOLS FOR MEDICAL PRODUCTS

Because many different languages are spoken within the European Union, symbols are used for better understanding and easier identification of medical devices. These symbols are standard throughout Europe and comply with the norm **DIN EN 980**.
**The following symbols are relevant to surgical sutures:**

| Symbol | Signification |
|---|---|
|  | **„DO NOT REUSE“** |
|  | **„PLEASE OBSERVE INSTRUCTIONS FOR USE“**<br>This symbol refers to the instructions for use inside the package. |
|  | **„BATCH NUMBER“**<br>This symbol is accompanied by the batch number (alongside the symbol). |
|  | **„EXPIRY DATE“**<br>This symbol is accompanied by the date (four digits for the year and two for the month). |
| **REF** | **„PRODUCT CODE“** |
|  | CE-mark, notified body |
|  | **„STERILE“** including<br>**„STERILIZATION METHOD“** e.g. symbol for **„ETHYLENE OXID STERILIZATION “** or **„IRRADIATION“** |
|  | **STORAGE TEMPERATURE** |
|  | **STORE IN DRY CONDITIONS** |
|  | **PROTECT AGAINST SUNLIGHT** |
|  | **„NON STERILE“**, sterilize prior to use |
|  | Observe instructions for use (available on website) |


# PRODUCT LABELLING



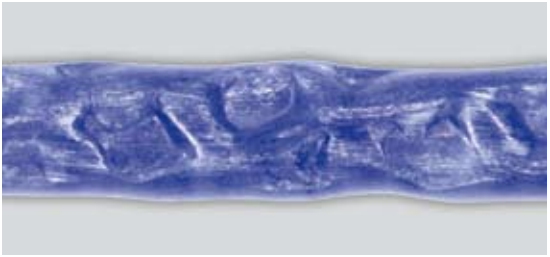


# SUTURE TECHNIQUES

# HANDLING

To prevent needle damage when suturing, it is recommended that you hold the needle between the middle and one third from the end. Holding the needle near its tip or at the end where the thread is loaded (end of the needle) can adversely affect its penetration and could cause the needle to break.

If touched at all, suture material should only be held by forceps or needle holders at the end of the thread. Each time it is held, the suture is damaged - and this is considerably more serious with monofilament threads. Any damage has an effect on the tensile strength of the suture.



needle holder damage to suture

Our specialists are continuously working on further ways of ensuring safe, problem-free removal of the suture from the suture packet. In recognition of this, our long pack vascular set was awarded the German Packaging Industry Award.

And a few tips for the problem-free removal of sutures from the packet:

wrong

right

When removing the suture material, grasp the suture packet in such a way that your thumb does not block the suture thread lying inside.

The same applies for all other types of suture packet:

wrong

right

wrong

right

# SUTURE TECHNIQUES

The surgeon's choice of suture type depends on a number of considerations. Sutures can be divided into two basic types, namely individual (interrupted) and continuous sutures. Each of these has its advantages and disadvantages:

Interrupted sutures permit very precise adaption of the wound edges. The risk of wound dehiscence is less than with continuous sutures, as the coming undone of a single suture does not result in the entire suture line coming apart. Also, the amount of suture material buried in the tissue is less and there is less interference with the blood supply of the wound area. On the other hand, interrupted sutures are more timeconsuming to insert, and require considerably more suture material than continuous sutures.

The advantage of continuous sutures is that they permit more even approximation of the two sides of the wound. They are also chosen for wounds that must prevent the passage of gas and fluids. The thread presses the lips of the wound firmly together along their entire length and in this way seals the wound completely. On the other hand, the resulting higher tension poses a threat to the nutrition of the wound area. Continuous sutures are quicker to insert and require less suture material.

## Examples of interrupted sutures

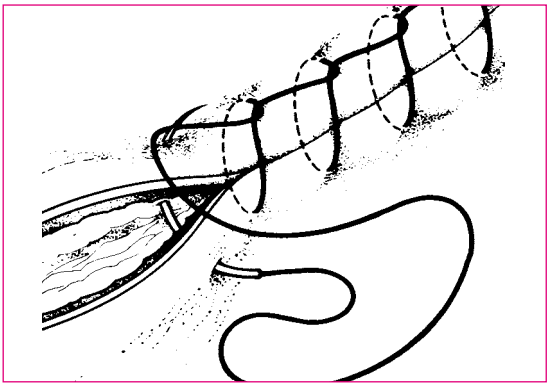
Interrupted over-and-over suture

Interrupted vertical mattress suture (Donati)

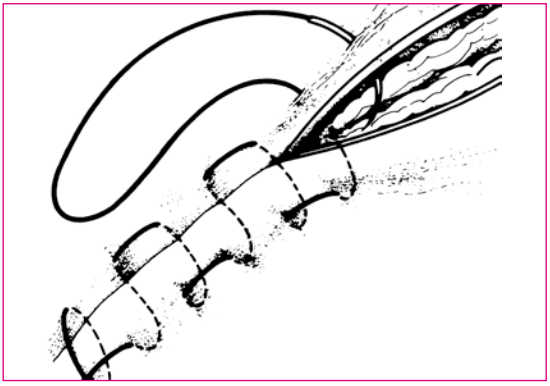
Interrupted vertical mattres suture (Allgöwer)

## Examples of continuous sutures

Continuous over-and-over suture

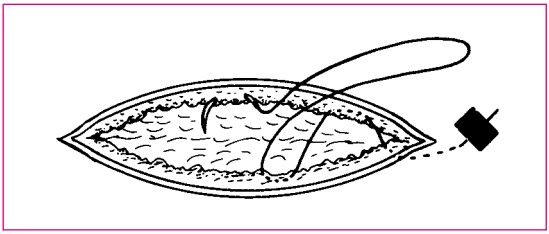


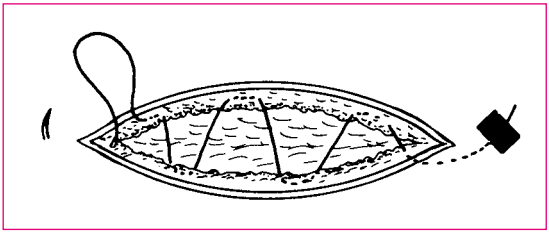
Continuous interlocking suture

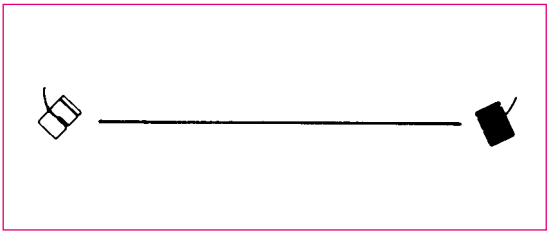


Continuous everting mattress suture

## Special sutures - INTRACUTANEOUS SUTURE

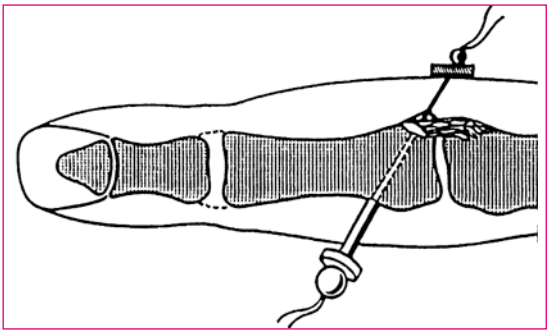




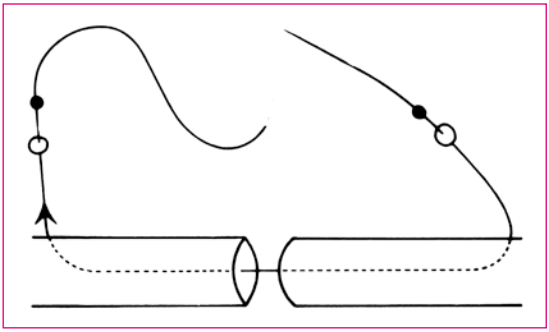


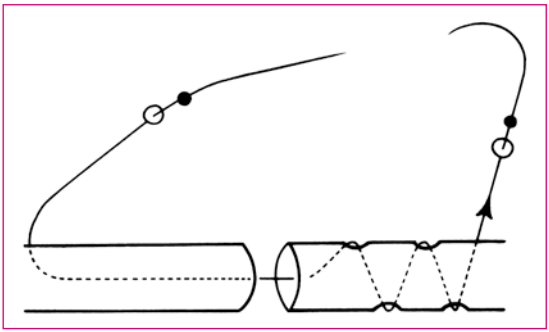
incutifix® - Fixation of subcuticular sutures greatly simplified with special clips.

## Special sutures - TENDON SUTURE

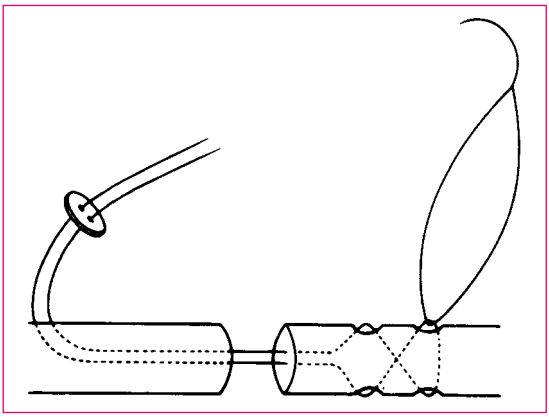


**according to Reck:**
Set of armed multifilament steel wire with accessories





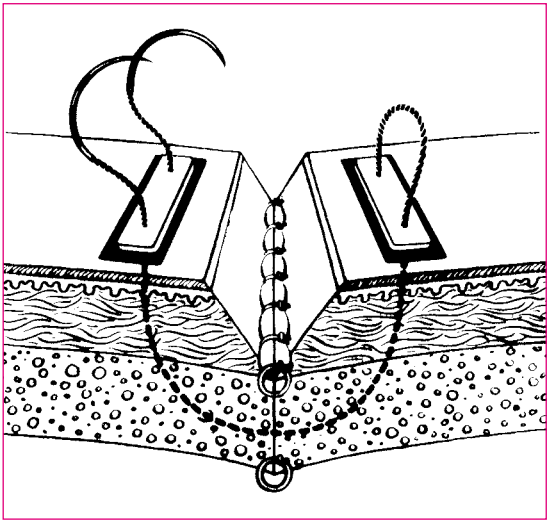
**according to Lengemann**
Set of double-armed multifilament steel wire for extractable tendon sutures.



**according to Bunnell:**
Extractable combination of steel wire or
SERALENE®

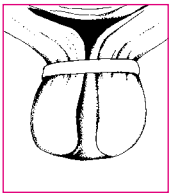
## Special sutures - TENSION SUTURE

Double-armed TERYLENE thread or covered steel wire with accessories for reinforcement of primary suture line in abdominal wounds.

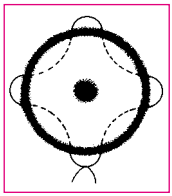


## Special sutures - CERVICAL SUTURE

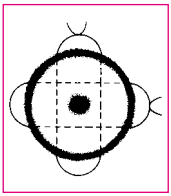
Polyester tape (Shirodkar) or thread (McDonald, Wurm-Hefner) for cerclage procedures in cervical incompetence during pregnancy.



**acc. to Shirodkar**



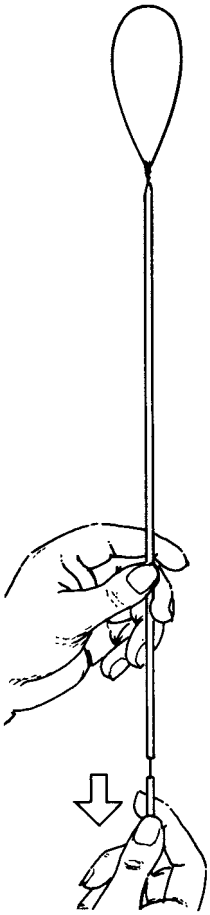
**acc. to McDonald**

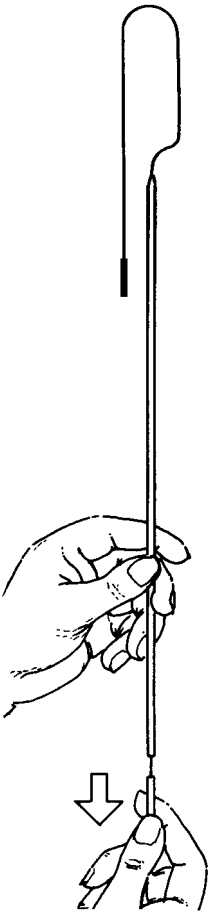


**acc. to Wurm-Hefner**

**SERAG-BINDER**
Prefashioned Roeder loop in knot pusher for endoscopic ligation of transected vascular structures

**Endo Suture**
Needle-suture combination in knot pusher for endoscopic suturing with extra- or intracorporeal knot-tying





KNOT-TYING TECHNIQUES

## Guidelines for knot-tying

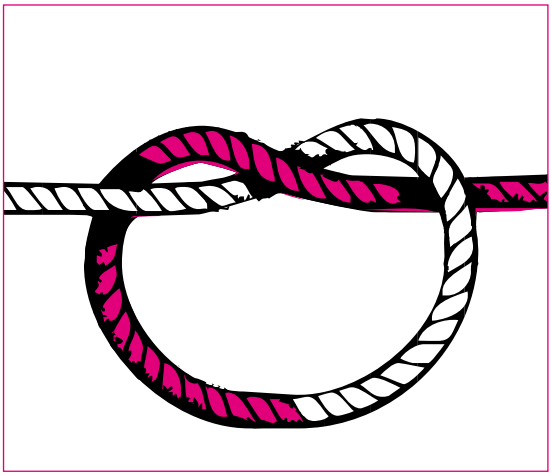
The surgeon must be able to tie a reliable knot as quickly as possible in every situation. The securest knots are fashioned with the tips of the fingers. The loops must be even and correctly orientated for tightening. Suture filaments must not be unravelled by twisting the loop in the opposite direction. The suture material should be stressed as little as possible and correct tension applied to each particular tissue. The knot-tying technique must be suited to the properties of the suture material and the requirements of the suture. The safest sutures are achieved by a sound knot-tying technique that exploits the properties of the suture material. The way in which the knots are tied is irrelevant. The essential thing is that the individual loops end up correctly positioned and aligned. Each knot can be tied correctly, regardless of how the suture ends are grasped, whether parallel or crosswise. The surgeon must therefore have mastered several knot-tying methods.

The following illustrations show how a reef knot is tied with two hands, one hand, and wholly or partly using surgical instruments. Endoscopic knot-tying techniques are also shown.

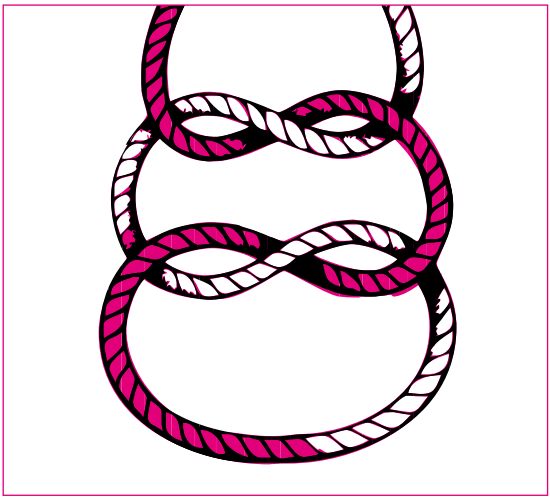
Generally, the two-handed knot is preferred, because suture tension is most easily controlled with the sensitive pads of the fingers. However, experienced surgeons find onehanded knots slightly faster. The instrument tie uses the least amount of suture material, but the thread may be damaged by the instrument.

# KNOT FORMS

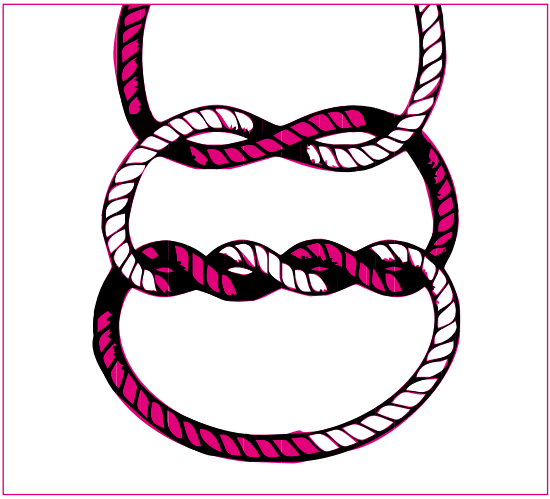
A secure knot is created only when one loop or throw is placed over another. The first throw can be made in various ways depending on the circumstances, and in every case determines the tension and position of the knot. The second throw is there only to prevent slippage and is therefore placed firmly against the first. Every suture material acts as a foreign body in tissue. Buried knots are therefore kept as small as possible and the ends cut short. The most commonly used knots are illustrated:



**Half-hitch**
First throw of a reef (square) or granny knot



**Reef (square) knot**
Two mirror-image half-hitches placed against each other. The suture ends are parallel. When pulled, the knot is increasingly tightened. This results in high knot-holding security.



**Surgical knot**
The first half-hitch is doubled and is therefore already relatively secure. This is the advantage of this knot. The drawbacks are that the knot is bulky and requires much suture material.

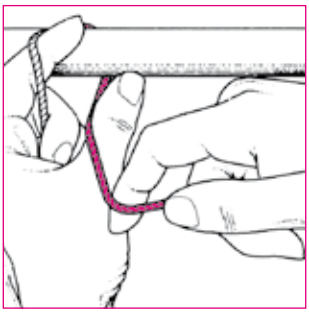
**The following pages illustrate knot-tying techniques such as:**

- the two-handed knot
- the one-handed knot
- instrument ties
- knot-tying technique in endoscopy
  extracorporeal intracorporeal
- instrument tie with pre-inserted „O“
- knotting recommendations for the SERA**SYNTH**® Endosuture

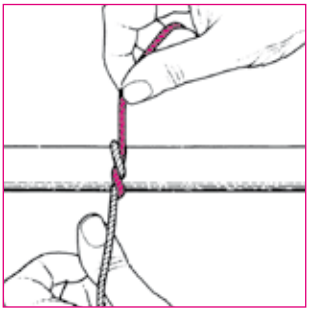
# KNOT TECHNIQUE

## Two-handed knot

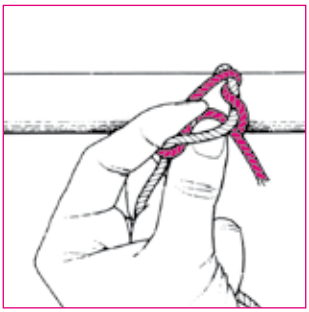
Both hands play an equal role in tying.



-1-



-4-



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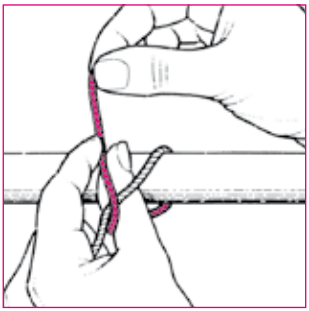

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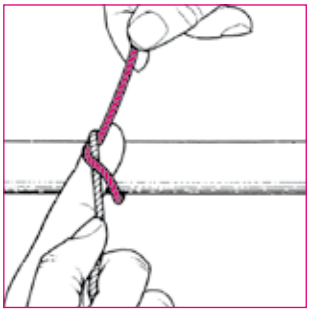

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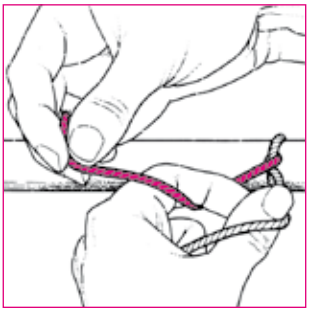

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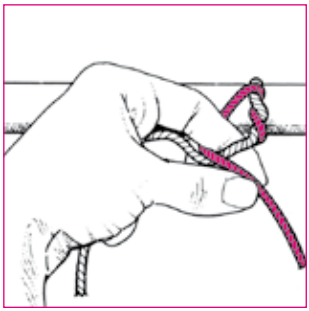

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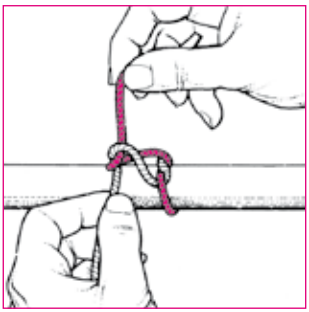

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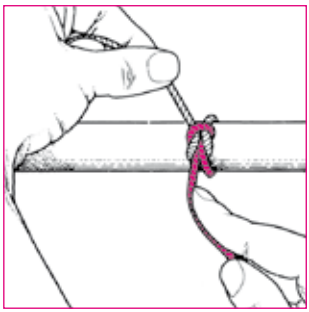

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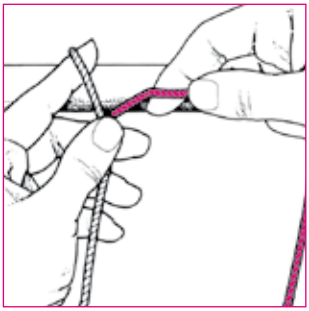
## One-handed knot

One hand holds the suture end in position while the other ties.



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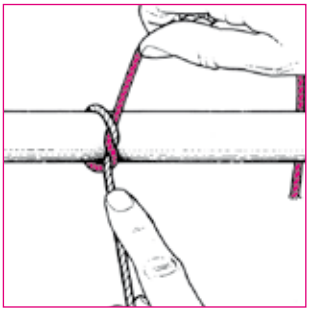

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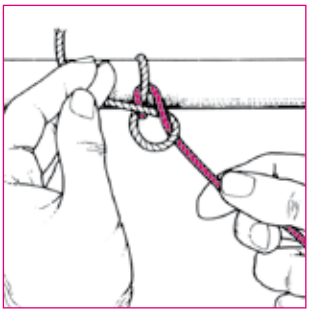

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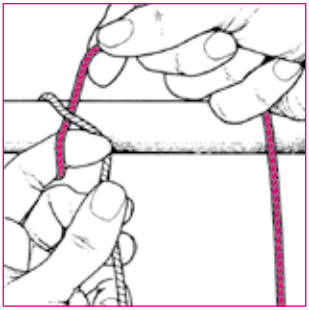

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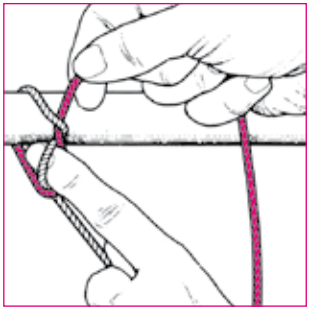

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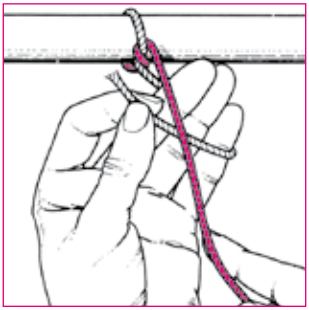

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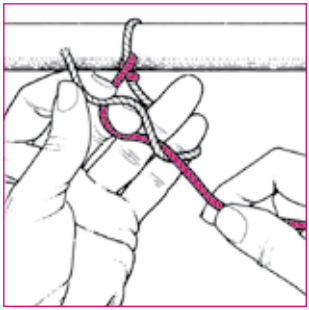

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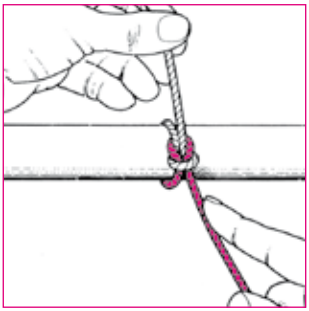
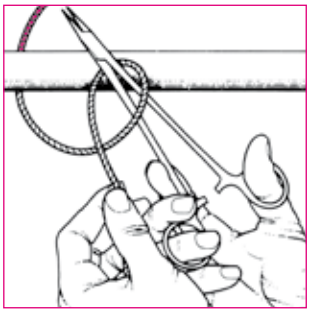


-8-

## Instrument ties

The suture ends are held and manipulated wholly or partly with the aid of instruments.



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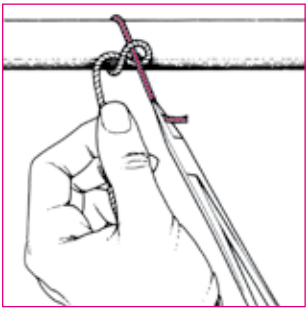

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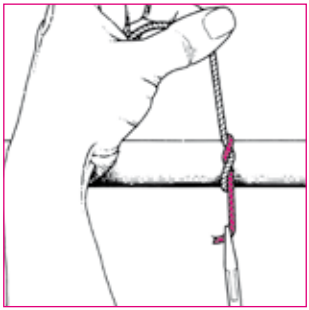

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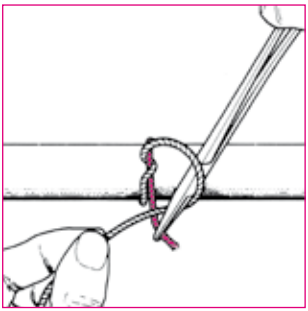

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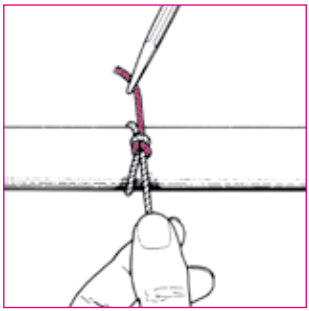

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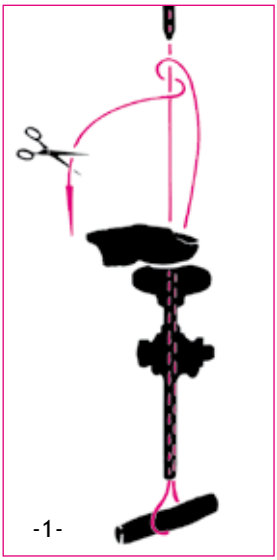
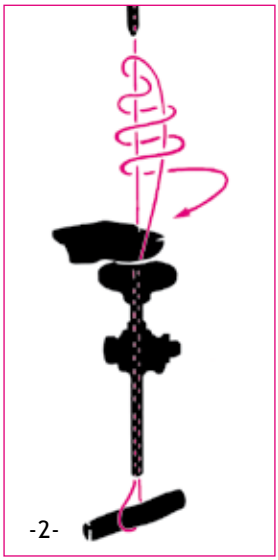
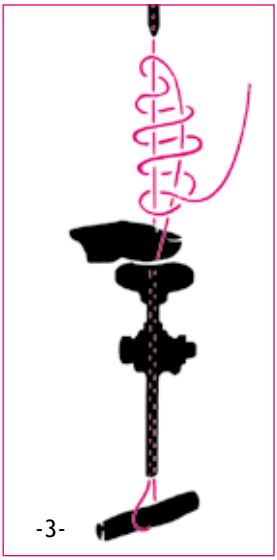
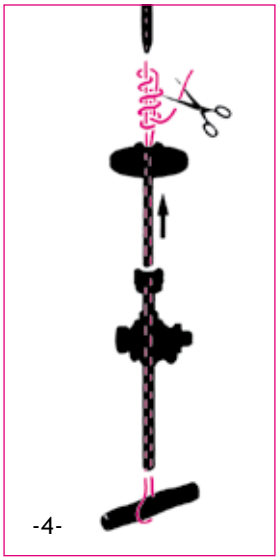
## Knot-tying technique in endoscopy

Extracorporeal knot



# Knot-tying technique in endoscopy

Intracorporeal surgical instrument knot

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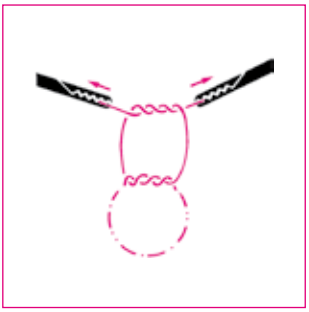


-6-

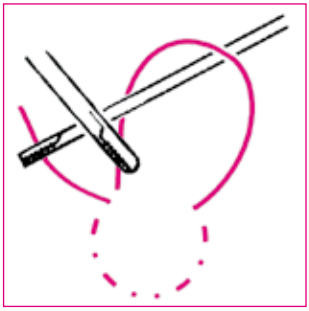
## Alternative instrument tie with pre-inserted thread „O“ (SERAFIT® stiffened).

This type of knot is rendered secure by repeated counterdirectional knotting.

-1-

-2-

-3-



-4-

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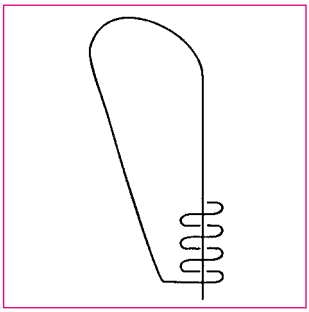
-6-

## Knotting recommendations for the SERASYNTH® Endosuture

Due to its material characteristics, not all the conventional knots are suitable for the Serasynth Endosuture. SERAG-WIESSNER has developed a novel knot which is marked by its ease of tying and good knot security. Please proceed as shown in the diagram:



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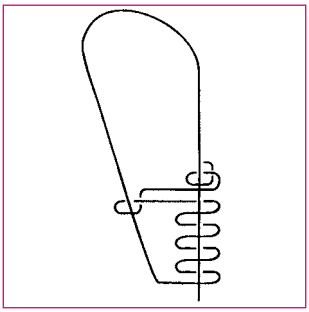

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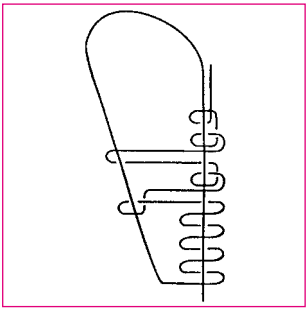

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