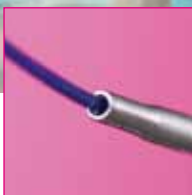


# POCKET GUIDE

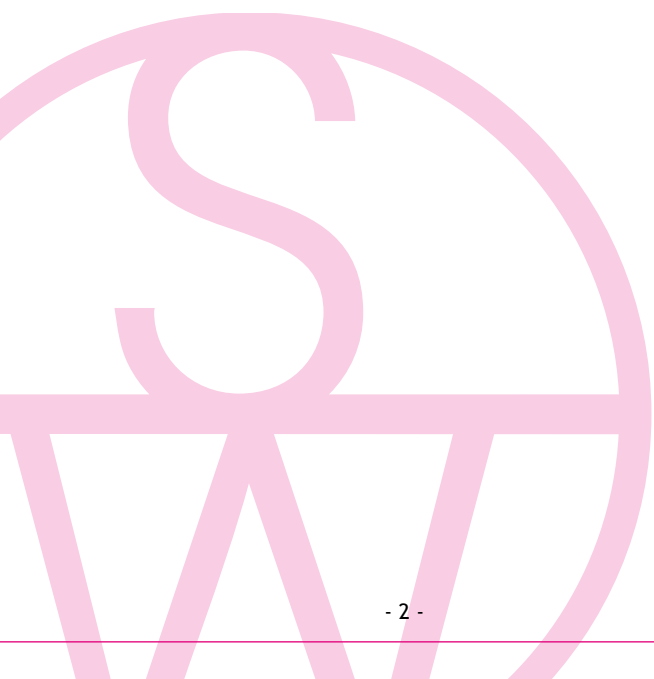
## SUTURE MATERIALS TECHNIQUES & KNOTS



**150**  
YEARS  
1866 - 2016



**SERAG  
WIESSNER**



# POCKET GUIDE TO SUTURE MATERIALS

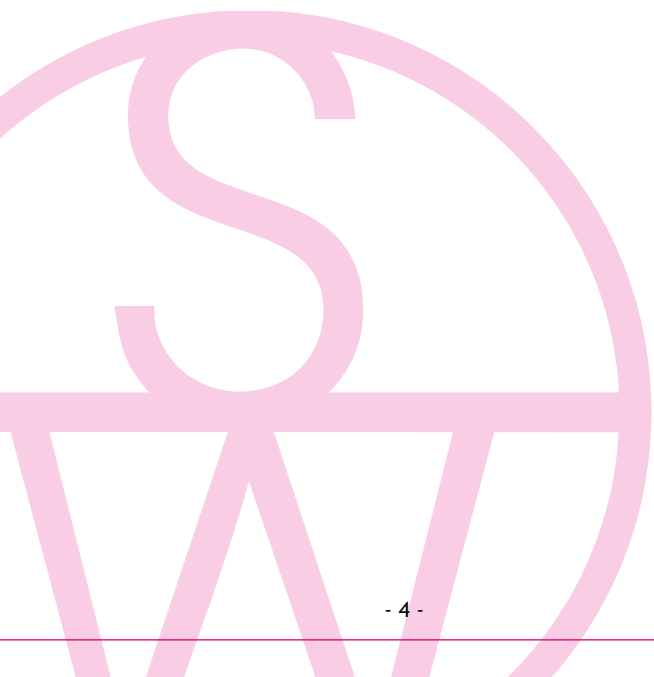
Suture materials are very closely related to surgery and have been throughout its history. Even with the introduction of alternative methods of wound closure such as strips and clips, suture materials are still of paramount importance. It is no exaggeration to claim that hardly any surgical procedure 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 GmbH & Co. KG  
Naila, Germany

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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<sup>2</sup>, 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. The recently completed logistics centre that takes account of the very latest aspects of energy management complies with the current demands on storage conditions for medicinal products and medical devices.

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 knotting 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.

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

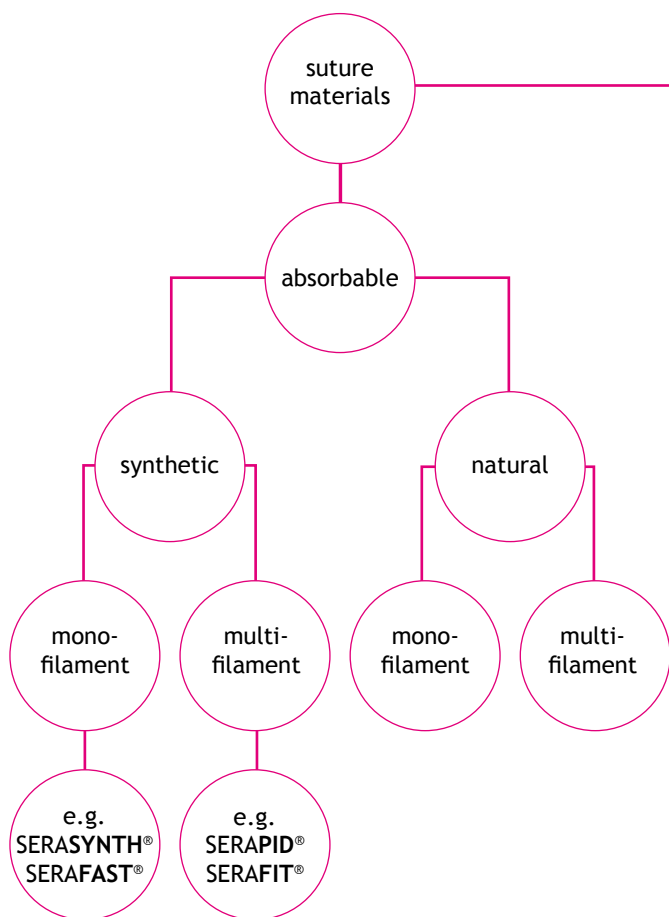
In response to the requirements of modern surgery and thanks to the efforts of users and manufacturers over the last few decades, a wide variety of sutures have now been developed.

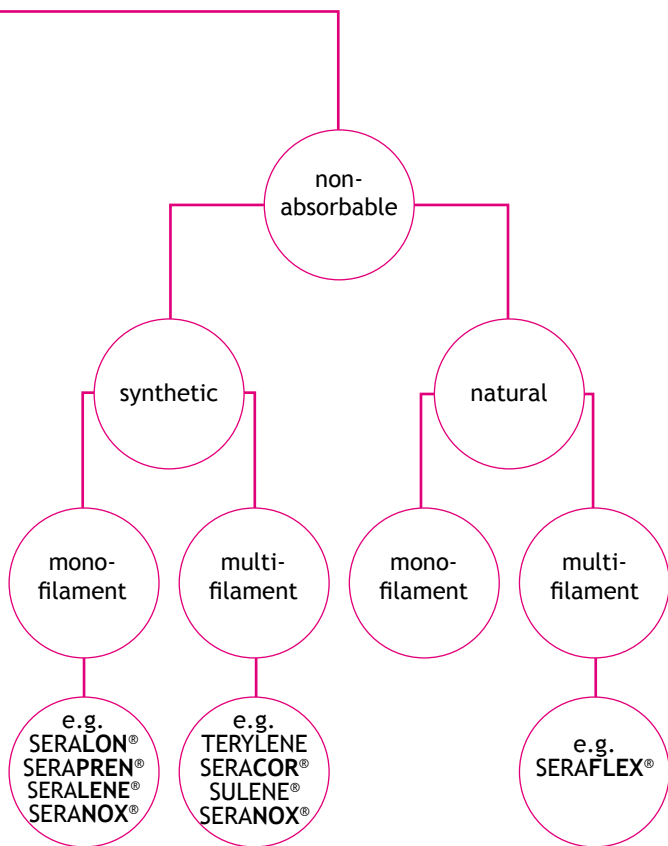
A close-up photograph of several medical sutures (threads) of different colors and textures. The sutures are arranged diagonally across the frame, creating a sense of depth and variety. The colors include shades of blue, green, yellow, and white. Some sutures have a smooth, glossy finish, while others have a more textured, braided appearance. The background is a solid, dark color, which makes the sutures stand out.

## 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.





## 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 half-life, 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:

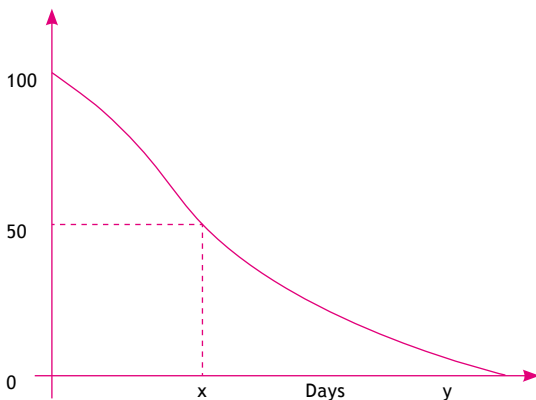
### Approximate absorption times of synthetic suture materials:

Material	Half-life (days)	Dissolution (days)
SERAPID®	5-7	30-42
SERAFIT®	15-20	60-90
SERAFAST®	8-13	90-120
SERASYNTH®	28-42	180-210

## Absorption

absorbable sutures

Tensile strength (%)



$x$  = 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. These also include the absorbable polymers based on polyglycolic acid, polydioxanone and other absorbable polyesters.

## 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 =  $3 \times 0.1 \text{ mm} = 0.3 \text{ mm}$ ). 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. SERAFIT® violet



Surgical suture, absorbable, monofilament, dyed e.g. SERASYNTH® violet, SERAFAST® violet




Surgical suture, absorbable, braided coated, undyed e.g. SERAFIT® undyed, SERAPID® undyed



Surgical suture, absorbable, monofilament, undyed e.g. SERAFAST® undyed

## Non-absorbable suture material

-  Surgical suture, non-absorbable, braided, coated, dyed e.g. TERYLENE und SULENE® green, SERACOR® green, SERAFLEX® 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. SERAPREN® and SERALENE® blue, SERALON® 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, SERACOR® und SERAFLEX® 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), SERANOX® multifilament
-  Surgical suture, non-absorbable, twisted, undyed e.g. SERANOX® multifilament
-  Surgical suture, non-absorbable, monofilament, undyed e.g. SERALON® undyed, SERANOX® 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/TI	POLYAMIDE titanised
PA	POLYAMIDE
PDO	POLYDIOXANONE
PET	POLYESTER
PGACL	POLYGLYCOLIC ACID-CAPROLACTONE
PGA	POLYGLYCOLIC ACID
PP	POLYPROPYLENE
PTFE	POLYTETRAFLUORIDETHYLENE
PVDF	POLYVINYLIDENE FLUORIDE
SILK	SILK
STEEL/TI	STEEL titanium-coated
STEEL	STEEL

Further symbols on page 52,  
Needle abbreviations are explained on page 43.





# SUTURES

## SERAFIT®




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





## SERAPID®

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



## SERAFAST®

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

## SERASYNTH®

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

## SERATAN®

<b>Material</b>	 POLYAMID titanised
<b>Symbol</b>	 undyed, monofilament, titanised
<b>Size</b>	USP 6/0 bis 2/0 EP 0,7 bis 3
<b>Absorption profile</b>	non-absorbable
<b>Available combinations</b>	
Needled	DQL Single sutures
<b>Advantages</b>	Titanisation promotes more rapid wound healing best cosmetic results useful alternative for hypertrophic scars
<b>Uses</b>	Cosmetic-plastic surgery Reconstructive surgery and after burn injuries

## SERALON® / NYLON


<b>Material</b>	 POLYAMID
<b>Symbol</b>	 undyed (SERALON®), monofilament  or  blue (SERALON®), black (NYLON) monofilament
<b>Size</b>	SERALON® USP 7/0 to 3+4 blue: EP 0,5 to 6 SERALON® USP 5/0 to 2/0 undyed: EP 1 to 3 NYLON: USP 11/0 to 8/0 EP 0,1 to 0,4
<b>Absorption profile</b>	non-absorbable
<b>Available combinations</b>	
Unneeded	Single sutures / multipacks cassette packs
Needed	DR / DRM / DRT / DS / DSL / DSS / DSX / GR / GS / HR / HRT / HRX / HS / HSL / KS Single sutures / multipacks
<b>Advantages</b>	best skin suture material outstanding sliding ability very high linear and knot-pull tensile strength with fine thread very pleasant handling economical large packs
<b>Uses</b>	Ligatures / general surgery / orthopaedics / plastic surgery

# SUPRAMID


## Material



 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

### Unneeded

Single sutures / multipacks  
cassette packs

### Needed

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

<b>Material</b>	 POLYESTER
<b>Symbol</b>	 undyed, multifilament (braided), coated or  green, multifilament, (braided), coated
<b>Size</b>	green:        USP 6/0 to 5 EP 0,7 to 7 undyed:      USP 5/0 to 8 EP 1 to 10
<b>Absorption profile</b>	non-absorbable
<b>Available combinations</b>	
Unneeded	Single sutures / multipacks cassette packs
Needled	DR / DRT / DS / DSS / FRX / GR / GS / HR / HRT / HRX / HS / KS / VSP Single sutures / multipacks
<b>Advantages</b>	universal suture material outstanding sliding ability very high linear and knot-pull tensile strength very pleasant handling economical large packs
<b>Uses</b>	Ligatures / holding sutures / marking / universal use




## SULENE®

Material	 POLYESTER
Symbol	 green, multifilament, (braided), coated
Size	USP 6/0 to 5 EP 0,7 to 7
Absorption profile	non-absorbable
<b>Available combinations</b>	
Unneeded	Single sutures / multipacks cassette packs
Needled	DR / DRT / DS / DSS / FRX / GR / GS / HR / HRT / HRX / HS / KS Single sutures / multipacks
Advantages	universal suture material optimal sliding ability very high linear and knot-pull tensile strength economical large packs
Uses	Ligatures / holding sutures / marking / MIS / universal use









## SERACOR®

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



## SERAPREN®

Material	 POLYPROPYLENE
Symbol	 blue, monofilament
Size	USP 8/0 to 1 EP 0,4 to 4
Absorption profile	non-absorbable
<b>Available combinations</b>	
Needled	DR / DRM / DRT / DS / DSL / DSS / HR / HRT / HRX Single sutures / multipacks / long pack / intracutaneous sutures
Advantages	best results for skin wound closure very high tensile strength high knot stability outstanding tissue tolerability long pack minimises memory effect
Uses	Ligatures / vascular surgery / microsurgery / orthopaedics / plastic surgery




## SERAMON®

<b>Material</b>	 POLYTETRAFLUORIDETHYLENE
<b>Symbol</b>	 undyed, monofilament
<b>Size</b>	USP 2/0 to 7/0 EP 3 to 0,5
<b>Absorption profile</b>	non-absorbable - inert
<b>Available combinations</b>	
<b>Needled</b>	DR, DRT, DS, DSS, HR, HRT, HS single sutures with and without pledgets Chordae Loops for heart valve reconstruction
<b>Advantages</b>	sustained tensile strength very pleasant handling outstanding sliding ability biological inert anti-adhesive minimized memory effect
<b>Uses</b>	vascular surgery / cardiac surgery / oral and maxillofacial surgery







## SERALENE®

Material	 POLYVINYLIDENE FLUORIDE
Symbol	 blue, monofilament
Size	USP 8/0 to 2 EP 0,4 to 5
Absorption profile	non-absorbable
<b>Available combinations</b>	
Needled	DR / DRM / DRT / DRTA / DSS / GR / GS / HR / HRT / HRX / HS / KS Single sutures / multipacks Award-winning long pack
Advantages	sustained tensile strength high knot stability scarcely any memory effect after stretching best results in vascular surgery
Uses	Ligatures / vascular surgery / microsurgery / plastic surgery

## SERAFLEX®

<b>Material</b>	 <b>SILK</b>
<b>Symbol</b>	 undyed, multifilament (braided), coated or  black, multifilament, (braided), coated
<b>Size</b>	black:        USP 7/0 to 5 EP 0,5 to 7 undyed:      USP 4/0 to 5 EP 1,5 to 7
<b>Absorption profile</b>	non-absorbable
<b>Available combinations</b>	
Unneeded	Single sutures / multipacks / cassette packs
Needled	DR / DRT / DS / DSS / DSX / GR / GS / HR / HRT / HRX / HS / HSM / KS / VSP Single sutures / multipacks
<b>Advantages</b>	high knot stability outstanding sliding ability very pleasant handling economical large packs
<b>Uses</b>	Ligatures / holding sutures / marking / oral and maxillofacial surgery / ophthalmology

## SERANOX® / SERANOX® Ti

<b>Material</b>	 STEEL
	 TITANIUM-COATED STEEL
<b>Symbol</b>	 multifilament, twisted or  multifilament, twisted, coated or  monofilament or  monofilament, coated (titanium nitride)
<b>Size</b>	USP 5/0 to 6 EP 1 to 8 SERANOX® Ti                      USP 5 to 7 EP 7 to 9
<b>Absorption profile</b>	non-absorbable
<b>Available combinations</b>	
Unneeded	Single sutures / multipacks
Needed	DS / GR / GS / HRK / HRT / HS Single sutures / multipacks / long packs Special combinations for trauma surgery and cardiac surgery
<b>Advantages</b>	highest tensile strength various accessories available with special laser attached needles for sternal closure also with SERANOX® Ti rapid healing process effect
<b>Uses</b>	Cardiac surgery (sternum) / orthopaedics / trauma surgery

A close-up photograph of two medical needles crossed at their tips. The needles are made of polished metal and are set against a solid, vibrant pink background. The lighting creates bright highlights and dark shadows along the length of the needles, emphasizing their sharp, curved points.

NEEDLES

## STEEL QUALITY FOR NEEDLES

Today it can be assumed that, at least with respect to European manufacturers, stainless steel (i.e. non-corrosive 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	90	0	3,5
	455	300	2	3,8
	300	700	4	5,4
HR-26	420	80	0	4,3
	455	400	2	5,0
	300	500	3	6,0
HR-36	420	100	0	5,3
	455	400	2	5,9
	300	700	4	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-needed 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 Committee 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	H = $\frac{1}{2}$ circle
D = $\frac{3}{8}$ circle	K = semi-curved
F = $\frac{5}{8}$ circle	L = spoon-shaped
G = straight	V = $\frac{1}{4}$ circle

**Needle type**

Q = square bodied
R = round-bodied
S = reverse cutting

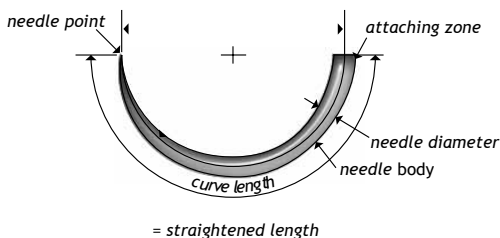
**Special characteristics**

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













**Examples**

DS 18    D     $\frac{3}{8}$  circle  
              S    reverse cutting  
              18    18 mm long (straightened length)

HRX 22    H     $\frac{1}{2}$  circle  
              R    round-bodied  
              X    extra strong  
              22    22 mm long (straightened length)



## Needle overview Atraumatic needles

<b>DQL</b>		$\frac{3}{8}$ circle, square bodied needle, lancet point, e.g. DQL-18
<b>DR</b>		$\frac{3}{8}$ circle, round-bodied needle, e.g. DR-20
<b>DRM</b>		$\frac{3}{8}$ circle, round-bodied needle with micro-point, e.g. DRM-6
<b>DRN</b>		$\frac{3}{8}$ circle, round-bodied needle, blunt, e.g. DRN-30
<b>DRT</b>		$\frac{3}{8}$ circle, round-bodied needle with trocar point, (trocar needle), e.g. DRT-17
<b>DS</b>		$\frac{3}{8}$ circle, reverse cutting needle, e.g. DS-15
<b>DSL</b>		$\frac{3}{8}$ circle, reverse cutting needle lancet point, e.g. DSL-6
<b>DSLA</b>		$\frac{3}{8}$ circle, reverse cutting needle lancet point, asymptotic, e.g. DSLA-4
<b>DSS</b>		$\frac{3}{8}$ circle, reverse cutting needle, special point, slim, e.g. DSS-18
<b>FRN</b>		$\frac{5}{8}$ circle, round-bodied needle, blunt, e.g. FRN-27
<b>FRX</b>		$\frac{5}{8}$ circle, round-bodied needle (extra strong needle), e.g. FRX-27
<b>GR</b>		straight, round-bodied needle, e.g. GR-20

GS



straight, reverse cutting needle,  
e.g. GS-25

HR



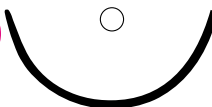
$\frac{1}{2}$  circle, round-bodied needle,  
e.g. HR-15

HRK



$\frac{1}{2}$  circle, round-bodied needle,  
short inlying blade, e.g. HRK-48  
(Pic. not in original size)

HRN



$\frac{1}{2}$  circle, round-bodied needle,  
blunt, e.g. HRN-40

HRT



$\frac{1}{2}$  circle, round-bodied needle  
with trocar point, (trocar needle),  
e.g. HRT-20

HRX



$\frac{1}{2}$  circle, round-bodied needle  
(extra strong needle), e.g. HRX-17

HS



$\frac{1}{2}$  circle, reverse cutting needle,  
e.g. HS-15

HSL



$\frac{1}{2}$  circle, reverse cutting needle  
with lancet point, e.g. HSL-5

HSM



$\frac{1}{2}$  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



$\frac{1}{4}$  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	SERALON®, SERAFAST® SERALENE®, SUPRAMID SERAPREN®
	vessel ligation, ligature	SERAFIT®
	fascia	SERAFIT®, SERAFAST® SERASYNTH®
	closure of abdominal wall	SERAFIT®, SERASYNTH®
Gastro- enterology	stomach and small intestine	SERAFIT® SERAFAST®
	large intestine	SERAFIT®, SERASYNTH®
	biliary ducts	SERAFIT®
	peritoneum	SERAFIT®, SERAFAST®
	hernia repair	SERAPREN®
Cardiac surgery	heart	SERACOR® SERAMON® CHORDAE LOOP SERAPREN® SERALENE®
Vascular surgery	blood vessels	SERAPREN®, SERALENE® SERAMON®
Plastic surgery	skin	SERALON®, SERAPREN® SERALENE®, SULENE® SUPRAMID, SERAFIT® SERAPID® SERASYNTH®
	blood vessels	NYLON, SERAPREN® SERALENE®
Micro surgery	nerves	SERAPREN®, SERALENE® NYLON














EP	Size		Needles
		USP	
1-3		5/0-2/0	DSS, DS
1-3		5/0-2/0	non-needed
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	DR, HR, HRT
0,5-1		7/0-5/0	DR
0,5-2		7/0-3/0	DR, DRM 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
Ophthalmology		NYLON, SERAFLEX®
Dental surgery		SULENE®, SERAFLEX® SERAFIT®, SUPRAMID® SERAMON®
Urology	kidneys	SERAFIT®, SERASYNTH®
	urinary tracts	SERAFIT®, SERASYNTH® SERAFAST®
	phimoses	SERAPID®
Thoracic surgery	lungs	SERAFIT®
	thorax closure	SERASYNTH® SERANOX®
Orthopaedics	tendons	SERAPREN®, SERALON® SERASYNTH®, SERANOX®
	ligaments	SERASYNTH®
	semilunar cartilage	SERASYNTH®
	bone	SERANOX®, SERASYNTH® BONE WAX
Gynaecology	pelvicfloor internal organs	SERAPID®, SERAFIT® SERASYNTH®, SULENE®
	mamma	SERAFAST®

EP	Size		Needles
		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 3-8		3/0-0 2/0-6	DS 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 ISO 15223-1**. The following symbols are relevant to surgical sutures:

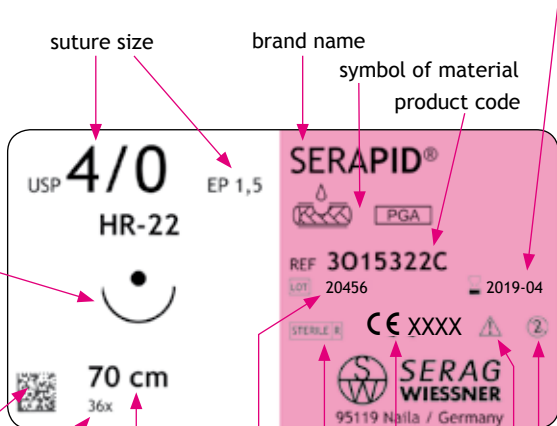
Symbol	Signification
	<b>„DO NOT REUSE“</b>
	<b>„PLEASE OBSERVE INSTRUCTIONS FOR USE“</b> This symbol refers to the instructions for use inside the package.
	<b>„BATCH NUMBER“</b> This symbol is accompanied by the batch number (alongside the symbol).
 2022-06	<b>„EXPIRY DATE“</b> This symbol is accompanied by the date (four digits for the year and two for the month).
<b>REF</b>	<b>„PRODUCT CODE“</b>
<b>CE XXXX</b>	CE-mark, notified body
 or 	<b>„STERILE“</b> including <b>„STERILIZATION METHOD“</b> e.g. symbol for <b>„ETHYLENE OXID STERILIZATION“</b> or <b>„IRRADIATION“</b>
	<b>STORAGE TEMPERATURE</b>
	<b>STORE IN DRY CONDITIONS</b>
	<b>PROTECT AGAINST SUNLIGHT</b>
	<b>„NON STERILE“</b> , sterilize prior to use
 <a href="http://www.serag-wiessner.de">www.serag-wiessner.de</a>	Observe instructions for use (available on website)



## PRODUCT LABELLING

needle symbol,  
needle illustration  
in original size

expiry date



quantity

suture  
length

batch  
number

CE-mark,  
notified body

not  
re-usable

### Barcode

encrypts company,  
product code, batch  
number, expiry  
date, quantity

sterilization method

observe  
instructions  
for use



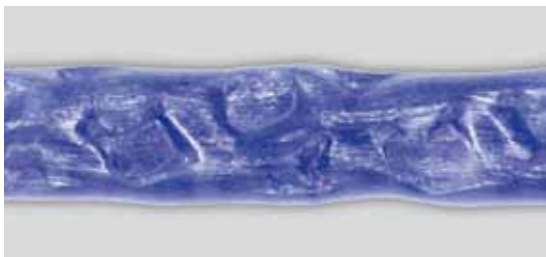
# SUTURE TECHNIQUES



## 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:



Open the lid



Grasp needle securely

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

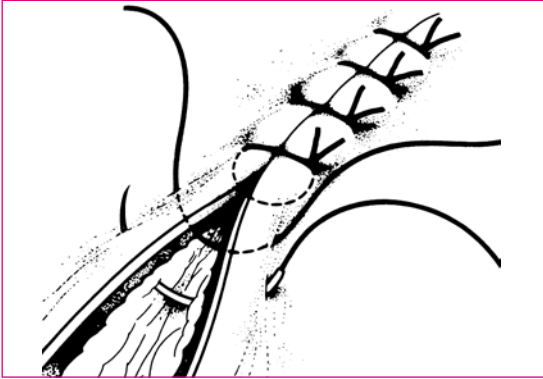
## SUTURE TECHNIQUES

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:

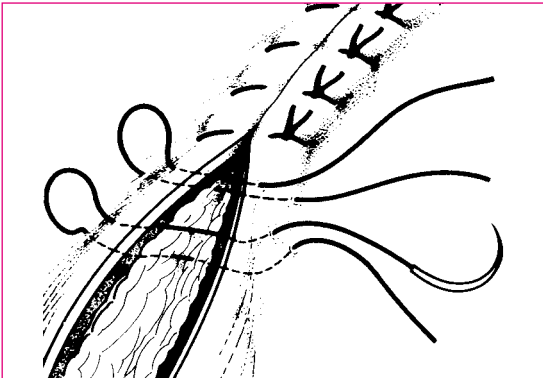
Interrupted sutures permit very precise adaptation of the wound edges. The risk of wound dehiscence is less than with continuous sutures, as the coming undone of a single suture does not result in the entire suture line coming apart. Also, the amount of suture material buried in the tissue is less and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

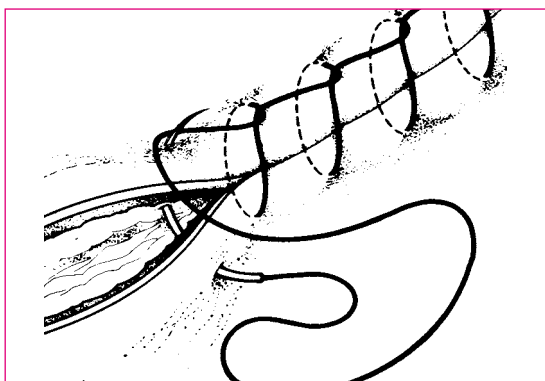


Interrupted vertical mattress suture (Allgöwer)

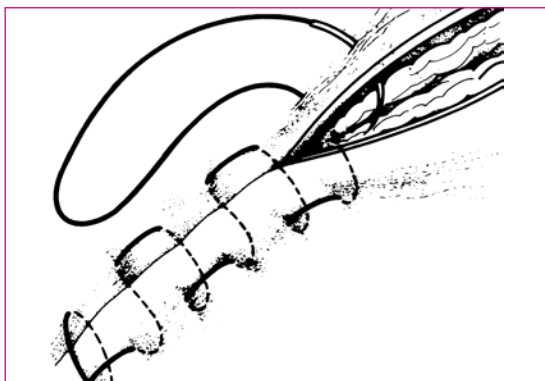
## Examples of continuous sutures



Continuous over-and-over suture

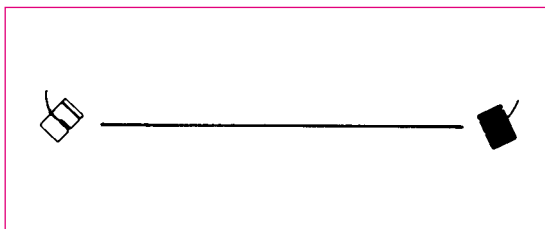
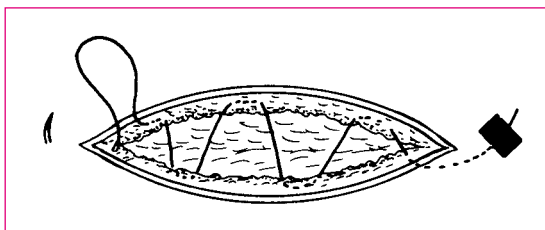
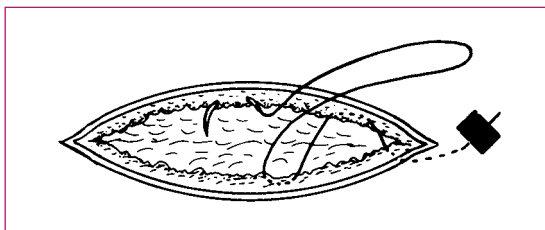


Continuous interlocking suture



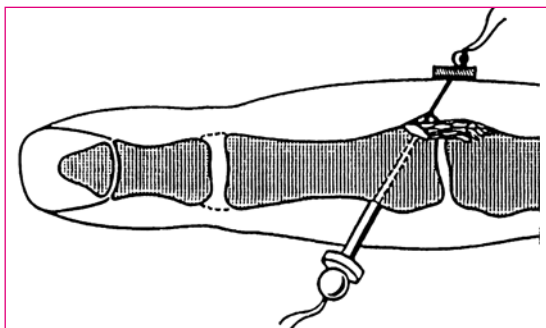
Continuous everting mattress suture

## Special sutures - INTRACUTANEEOUS SUTURE



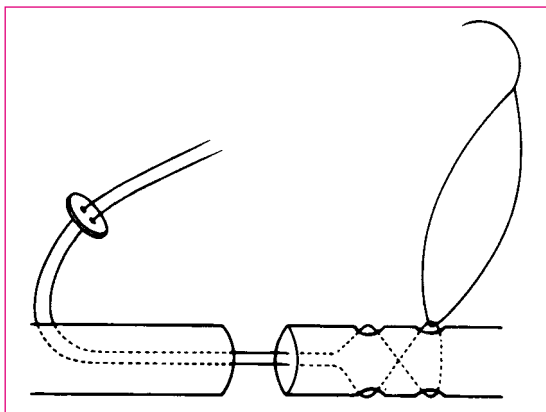
incutifix® - Fixation of subcuticular sutures greatly simplified with special clips.

## Special sutures - TENDON SUTURE



**according to Reck:**

Set of armed multifilament steel wire with accessories

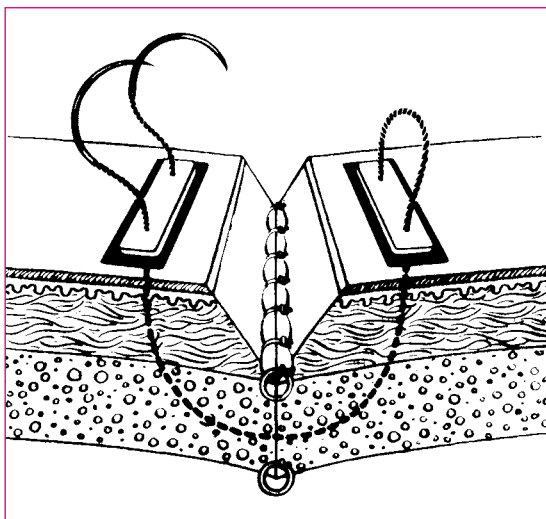


**according to Bunnell:**

Extractable combination of steel wire or SERALENE®

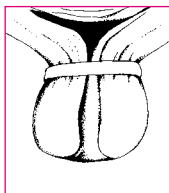
### Special sutures - TENSION SUTURE

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

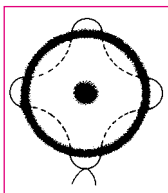


### Special sutures - CERVICAL SUTURE

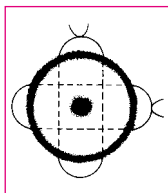
Polyester tape (Shirodkar) or thread (McDonald, Wurm-Hefner) for cerclage procedures in cervical incompetence during pregnancy.



acc. to  
Shirodkar



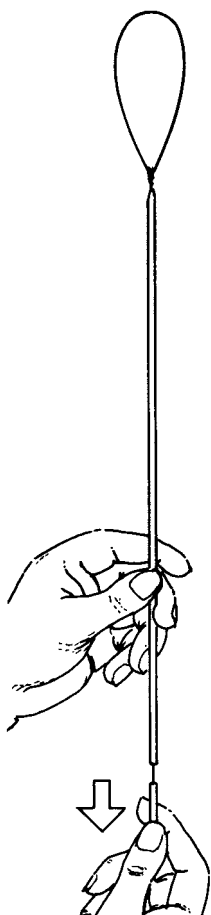
acc. to  
McDonald



acc. to  
Wurm-Hefner

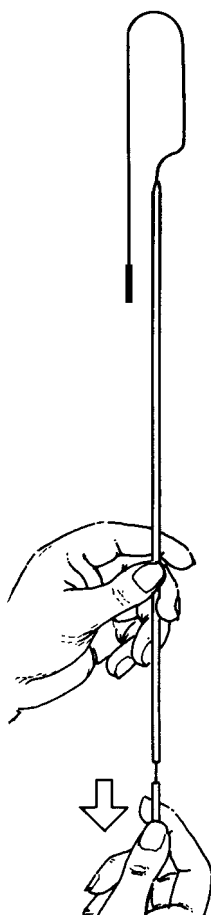
### SERAG-BINDER

Prefashioned Roeder loop in knot pusher for endoscopic ligation of transected vascular structures



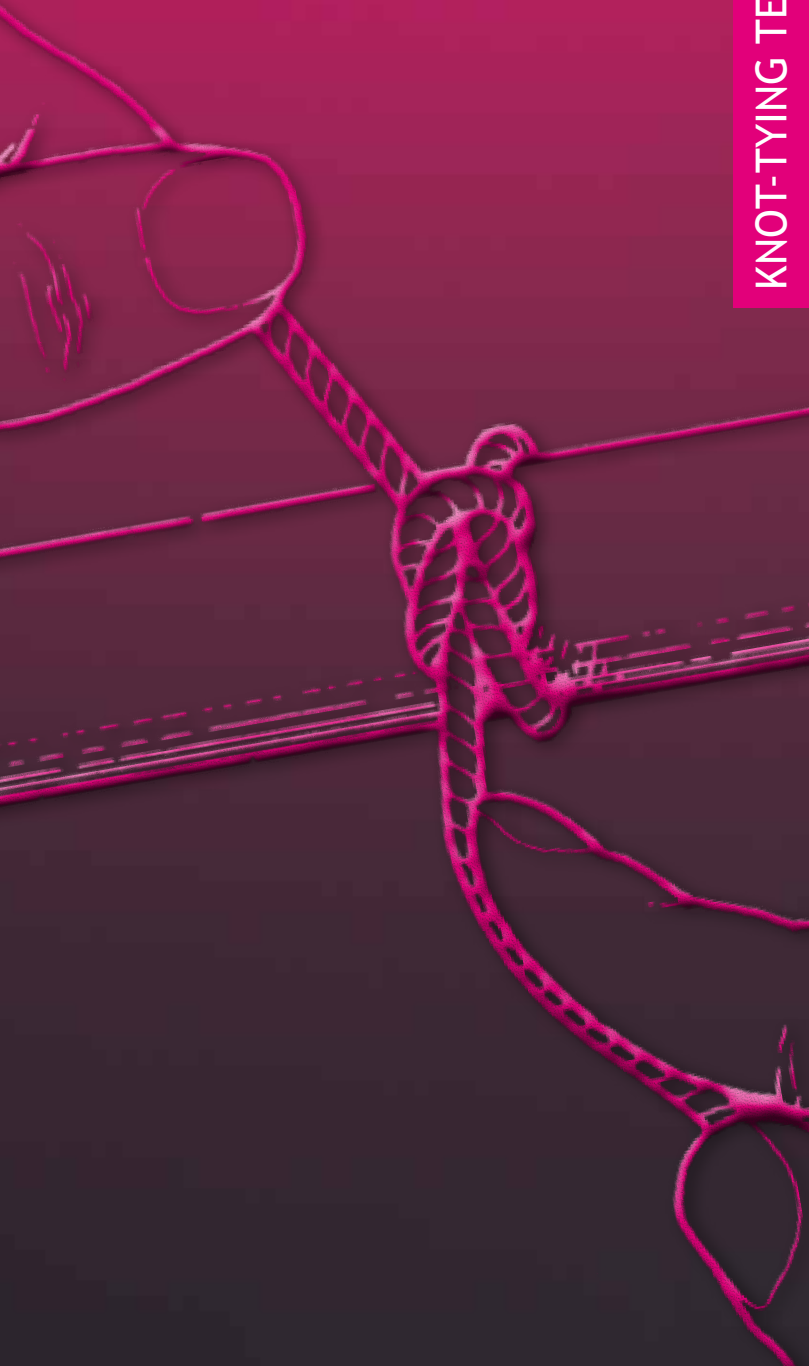
### Endo Suture

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





# KNOT-TYING TECHNIQUES



### Guidelines for knot-tying

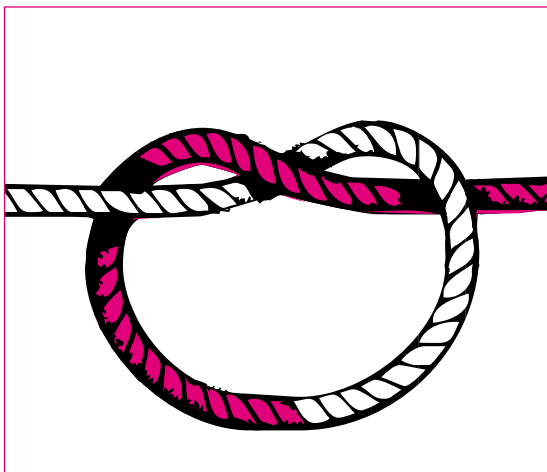
The surgeon must be able to tie a reliable knot as quickly as possible in every situation. The securest knots are fashioned with the tips of the fingers. The loops must be even and correctly orientated for tightening. Suture filaments must not be unravelled by twisting the loop in the opposite direction. 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.

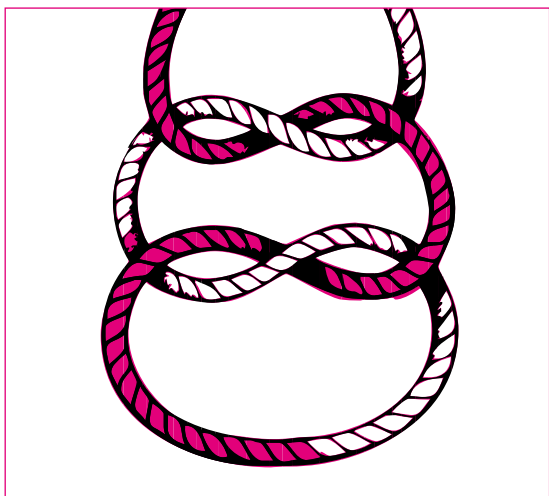
## KNOT FORMS

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:



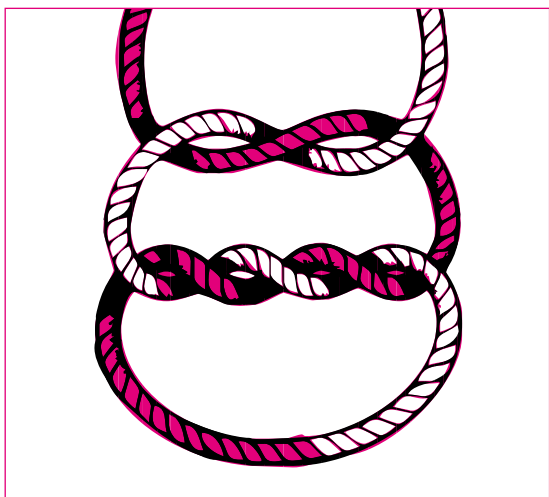
### Half-hitch

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.

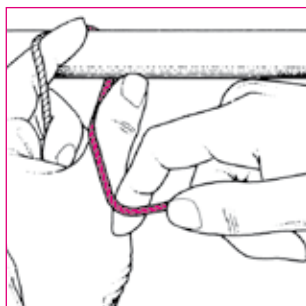
The following pages illustrate knot-tying techniques such as:

- 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  
SERASYNTH® Endosuture

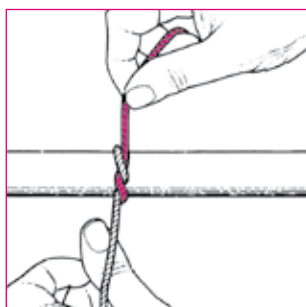
# KNOT TECHNIQUE

## Two-handed knot

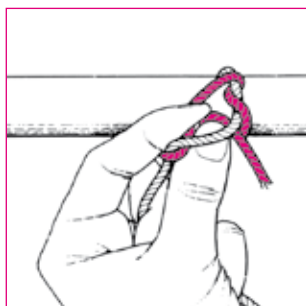
Both hands play an equal role in tying.



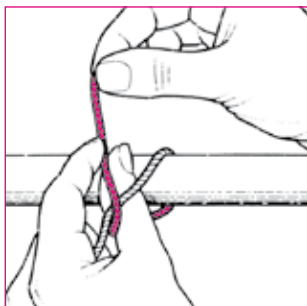
-1-



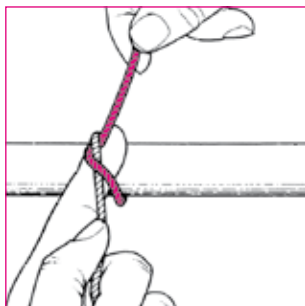
-4-



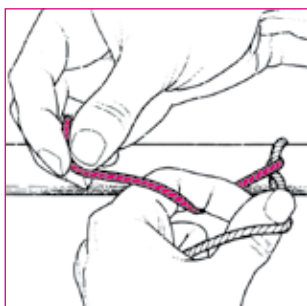
-7-



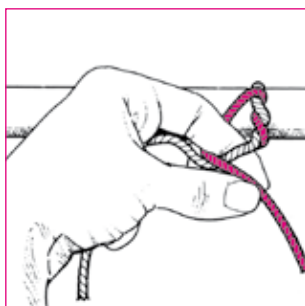
-2-



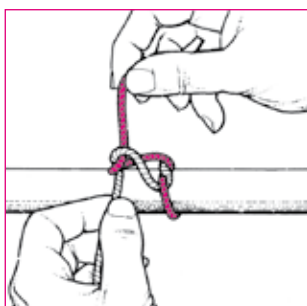
-3-



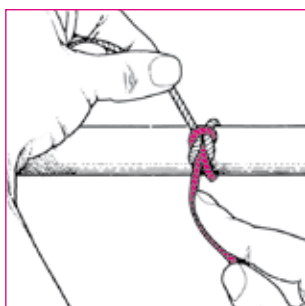
-5-



-6-



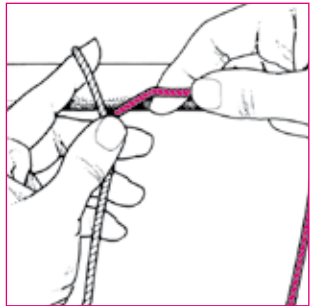
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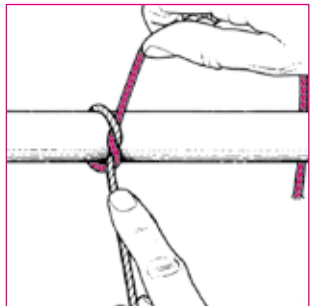
-9-

## One-handed knot

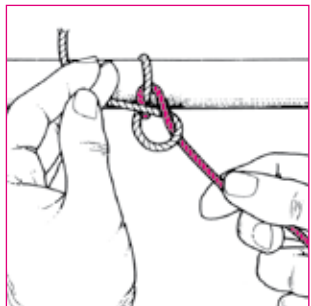
One hand holds the suture end in position while the other ties.



-1-

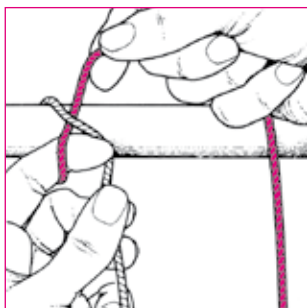


-4-

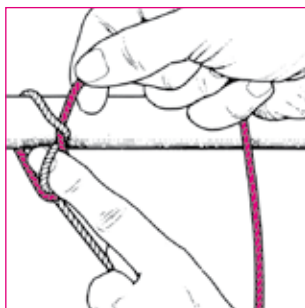


-7-

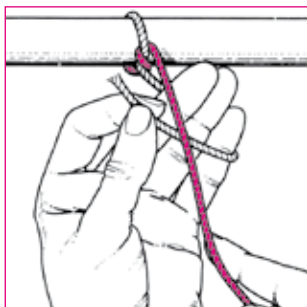




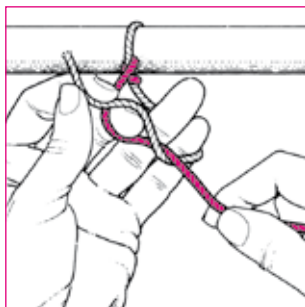
-2-



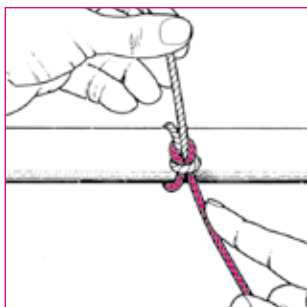
-3-



-5-



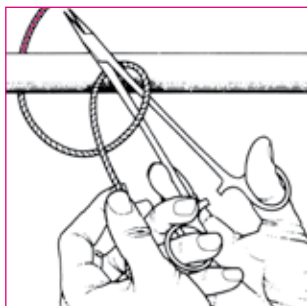
-6-



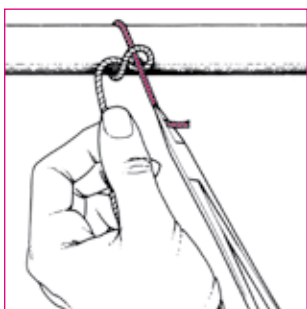
-8-

## Instrument ties

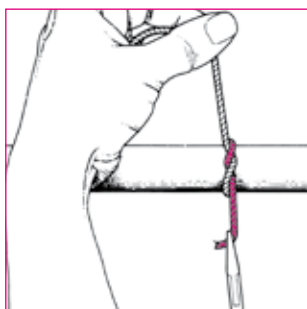
The suture ends are held and manipulated wholly or partly with the aid of instruments.



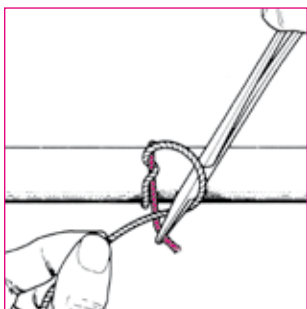
-1-



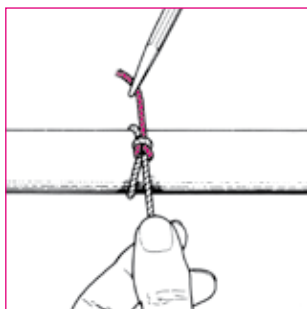
-2-



-3-



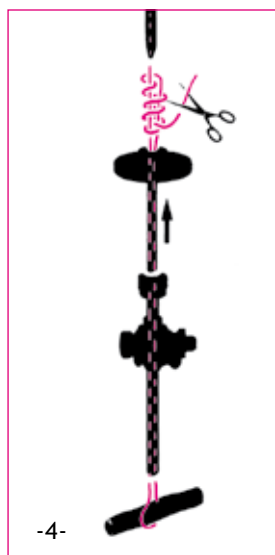
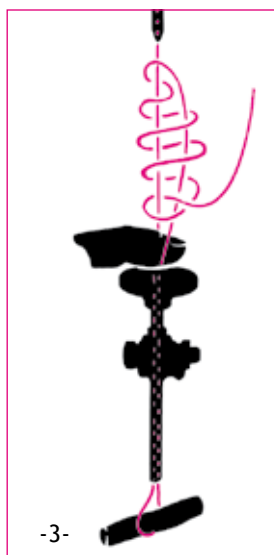
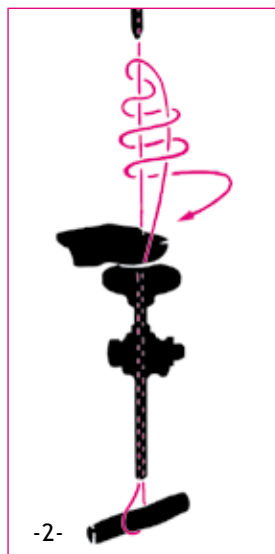
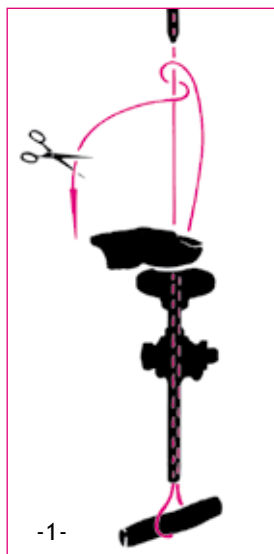
-4-



-5-

## Knot-tying technique in endoscopy

Extracorporeal knot



## Knot-tying technique in endoscopy

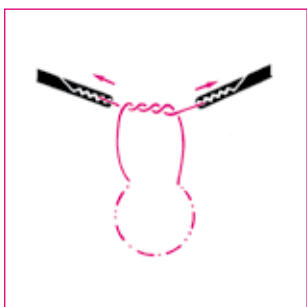
Intracorporeal surgical instrument knot



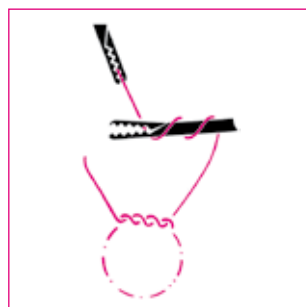
-1-



-2-



-3-



-4-



-5-



-6-

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

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



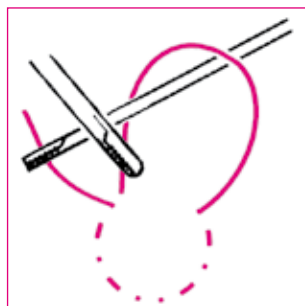
-1-



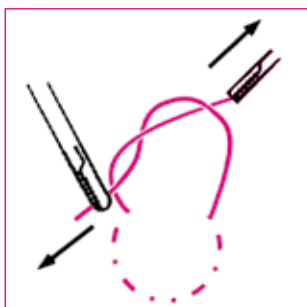
-2-



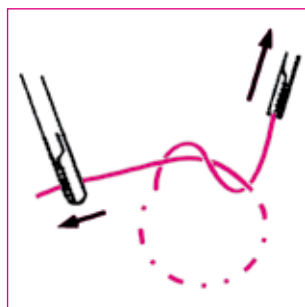
-3-



-4-



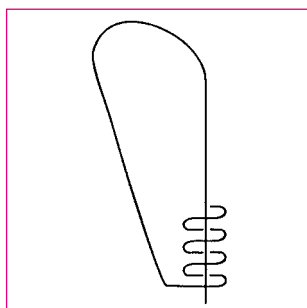
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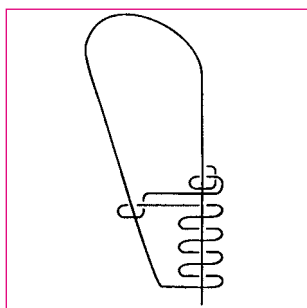
-6-

## Knotting recommendations for the SERASYNTH® Endosuture

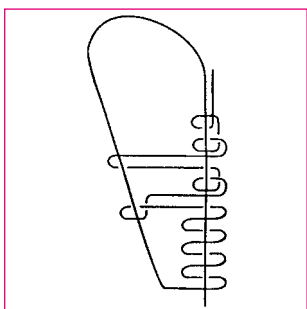
Due to its material characteristics, not all the conventional knots are suitable for the Serasynt Endosuture. SERAG-WIESSNER has developed a novel knot which is marked by its ease of tying and good knot security. Please proceed as shown in the diagram:



-1-



-2-



-3-



**150**  
YEARS  
1866 - 2016



**SERAG**  
**WIESSNER**

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