

 **RESORBA**[®]
SUTURES & SUPPLIES

resorba.com



Suture Manual



Advanced Medical Solutions

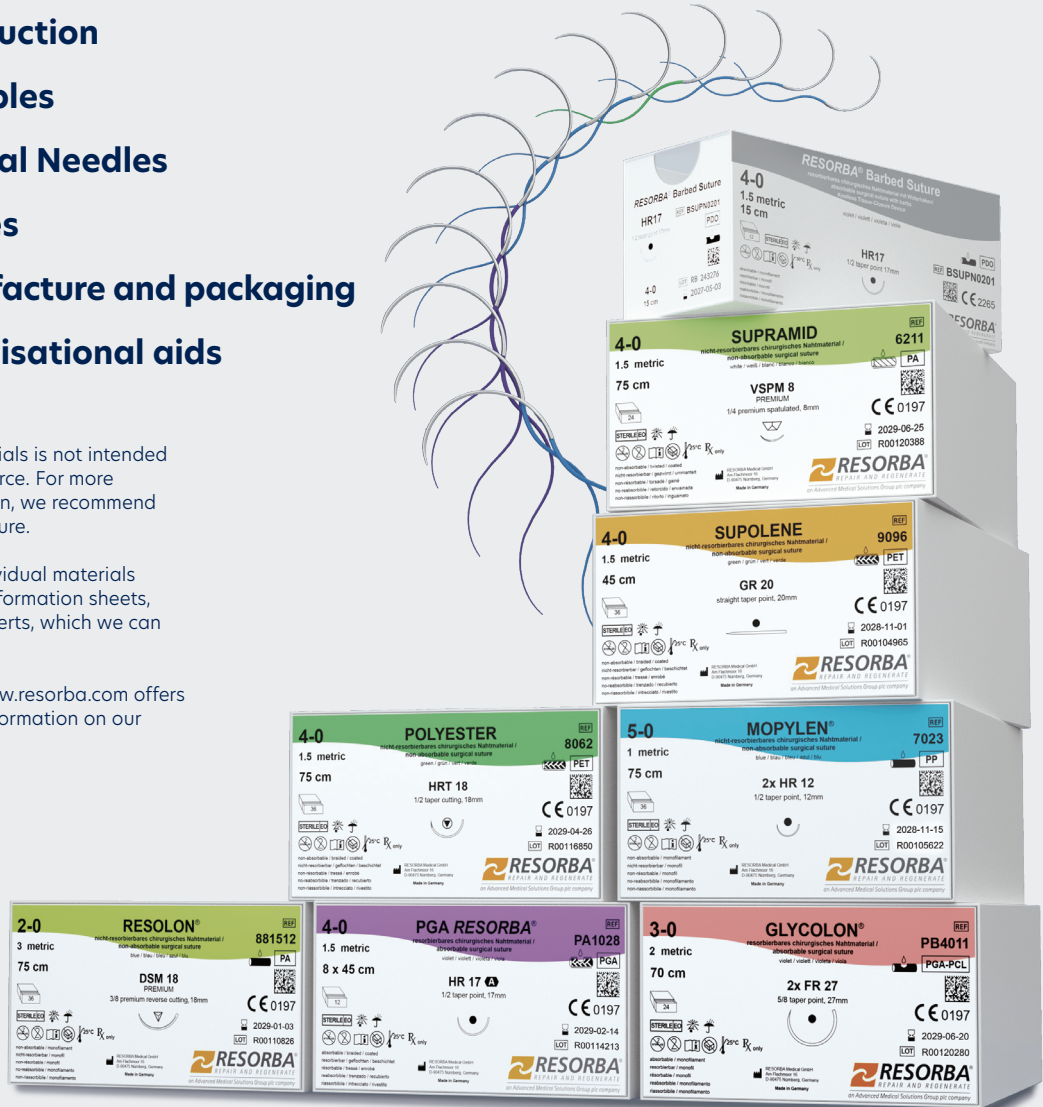
Content

- Page 3 **Introduction**
- Page 6 **Principles**
- Page 12 **Surgical Needles**
- Page 15 **Sutures**
- Page 31 **Manufacture and packaging**
- Page 36 **Organisational aids**

This booklet on suture materials is not intended as a fully comprehensive source. For more detailed technical information, we recommend consulting specialized literature.

Detailed information on individual materials is available in our product information sheets, catalogues and package inserts, which we can provide upon request.

Additionally, our website www.resorba.com offers up-to-date and extensive information on our products and innovations.



Introduction



In nature, injured or damaged tissue layers must be quickly closed to maintain the integrity and function of the organism. This approach has been adopted by humans from nature.

One primary goal of modern wound care is to preserve intact tissue and support damaged areas. Our suture products, based on biocompatible raw materials, enable targeted use for all types of wound care and guarantee the best possible tissue compatibility.

Surgical suture material is a typical medical product used to repair tissue. Most wound closures are still performed with sutures. The mechanical properties of the materials used are of utmost importance to temporarily replace the lost strength.

Absorbable suture materials, such as PGA RESORBA®, support the body's natural repair processes until form and function are restored. These materials are then broken down by the body.

Non-absorbable suture materials, such as MOPYLEN®, provide long-lasting support and excellent biocompatibility, particularly beneficial for long-term implants.

A wide variety of suture materials is available today for wound closure, specifically designed to suit various applications and selected to match the unique properties of the tissue.

Requirements for an ideal suture:

- high tensile strength
- high knot security
- good tie down
- no capillary function
- good tissue tolerance
- easy passage through tissue
- sterile presentation

The optimum use of any particular suture is determined by its:

- absorption characteristics
- thread structure, composition and diameter
- elasticity and stability
- tissue acceptance
- tensile strength

Introduction

A journey into the history of surgical sutures

The development of surgical suture revisited

3000 BC

First reference to a wound suture in ancient Egyptian texts.

1900 - 1600 BC

Oldest surviving description of wound care in Papyri named after F. Smith (1862) and Ebers (1873), from about 1900 - 1600 BC.

1100 BC

Oldest surviving suture placed about 1000 BC in the abdomen of a mummy (Rodegra 1982). Linen was already being used as suture material at that time.

500 BC

Susruta, an Indian was the first to describe in detail wound sutures and the material used for it, e.g. bowstring (earliest absorbable suture material), linen thread, plant fibres, tree bark sutures and thin strips cut from tanned skin.

460 BC - 199 AD

The great medical books by Hippocrates (460 - 377 BC), the most famous physician of antiquity the Roman physician Celsus (25 - 50 AD) and the physician Galen (129 - 199 AD) already contain detailed descriptions of many suture techniques. Celsus distinguished between single and continuous sutures and Galen was the first to recommend thin strings made of gut for ligating bleeding vessels.

625 - 690

Paulus of Agina was the first physician to treat a bone fracture by winding wire around it.

1732

Various suturing techniques still in common use today were drawn on animal skin (exhibited at the Germanic National Museum in Nuremberg).

1827 - 1912

Wound infections became preventable after the introduction of the first usable disinfection and sterilisation methods (antiseptics) by Lister (1827 - 1912) and Schimmelbusch (1860 - 1895).

▼ Production of catgut around 1930



Anschlingen der Darmteile (Catgutherstellung)

R. GHAF & Co. A.-G.
Nürnberg

12

Introduction

1868

Lister, a surgeon discovered absorbable sutures made of sheep gut string. He disinfected the sutures with carbolic acid to keep them germ-free. This is the origin of resorbable catgut sutures.

1900

The beginning of the industrial manufacturing of suture material (catgut) was based on technical experience gathered in the meantime in making strings for musical instruments.

1908

In 1908 F. Kuhn (1866 - 1929), a German surgeon demanded the exclusive use of surgical sutures made of catgut that had been made under especially clean, partly sterile conditions. Catgut (sterilized with potassium iodide) became the most commonly used surgical suture material next to twine and silk. After the introduction of catgut an intensive search began for other absorbable suture materials. A unsuccessful attempt was made to obtain absorbable thread from animal tissues (tendon from kangaroo tails;

skin, arteries, strips of muscle, tendon and nerves from whale, rabbit, dog, deer, camel, turtle and others).

1931

First production of synthetic threads from polyvinyl alcohol.

1939

Perlon was specially treated to produce the synthetic thread Supramid to meet the particular requirements in surgery. After World War II it was joined by synthetic threads made from polyester and polypropylene.

Until 1960

Sutures were sterilized by bactericidal chemical solutions or by heating (steam).

Since 1960

Introduction of safe modern methods of sterilization with ethylene oxide gas or gamma irradiation.

1968

First synthetic suture threads made from polyglycolic acid. The production of "atraumatic sutures" was also further

developed and improved starting at the beginning of 1970. The basic idea of a minimal transition in diameter from needle to thread for providing the most sparing way of passing a suture through tissues was put forward over 100 years ago (Gaillard) and has been used since about 1920.

In principle, different types of suture packaging have been available since the beginning of the industrial manufacture of sutures. But it was only with the development of packaging techniques with synthetic materials around 1960, and new methods of sterilisation that it became possible to make the sterile and ready-to-use packs available nowadays.



▲ Early packaging of sutures

Principles

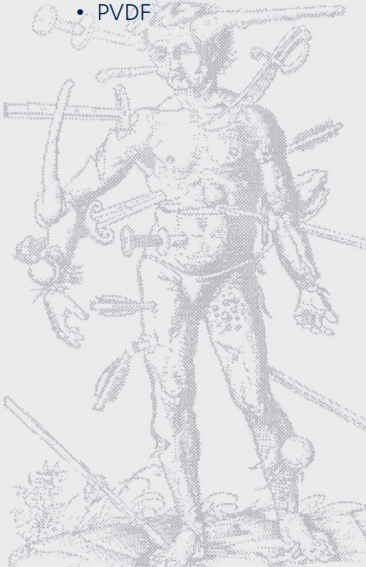
Historical classification according to raw materials

Natural starting materials

- Silk
- Linen (twine)
- Animal gut (catgut)
- Steel

Synthetic starting materials

- Polyglycolic acid
- Polylactide
- Polyamide
- Polyester
- Polypropylene
- Poly(p-dioxanone)
- PVDF



Modern classification according to absorption characteristics

Non-absorbable

- MOPYLEN®
- MOPYLEN® CV
- RESOPREN®
- POLYESTER
- SUPOLENE
- NYLON
- RESOLON®
- SUPRAMID

- SILK
- STAINLESS STEEL

Long-term wound support

- CAPROLON®
- PDO RESORBA™
- RESORBA® Barbed Suture

Mid-term wound support

- PGA RESORBA®

Short-term wound support

- PGA *resoquick*™
- GLYCOLON®

	Monofilament material	Multifilament material
Properties	no capillarity no sawing effect good knotting properties easy passage through tissue	very high tensile strength high knot security very supple simple handling
Absorbable material	GLYCOLON® CAPROLON® PDO RESORBA™ RESORBA® Barbed Suture	PGA <i>resoquick</i> ™ PGA RESORBA®
Non-absorbable material	MOPYLEN® MOPYLEN® CV RESOPREN® NYLON RESOLON® SUPRAMID* STAINLESS STEEL	POLYESTER SUPOLENE SUPRAMID** SILK

Absorption

Absorbable sutures approximate the tissues during the healing process. During this time the suture's tensile strength will gradually diminish. Absorbable suture material is metabolised by endogenous proteolytic enzymes or by hydrolysis (in the case of PGA *resoquick*[™], GLYCOLON[®], PGA RESORBA[®], CAPROLON[®], PDO RESORBA[™] and RESORBA[®] Barbed Suture).

Non-absorbable sutures remain almost unchanged when placed within body tissues and are encapsulated within the wound scar tissue by the

organism. The sutures used for skin closure are removed once the scar tissue has become sufficiently firm to hold the wound edges together (usually after 7 to 14 days). It has to be distinguished as follows:

Absorption time

The period in which the suture loses 50 % of its knot tensile strength.

Dissolution

The period during which the suture completely dissolves within the tissue.

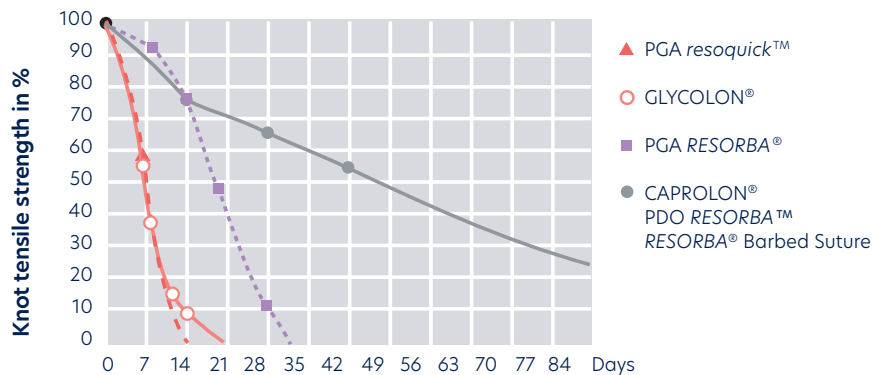
Disintegration

The period during which essentially non-absorbable suture breaks down by degradation into (smaller) pieces and thus losing its strength (e.g. polyamide).

Characteristics of absorption

Different indications also require different tensile strengths and absorption characteristics. These particular features of different sutures can be achieved by the choice of the material and modifying the production process. In addition to the immediate, moderately quick or delayed loss of tensile strength there is also the corresponding duration of absorption.

Any given thread material can only fulfil its purpose as long as it has the desired tensile strength.



The graph shows a simplified representation of the respective tear force losses over time. Data of GLYCOLON[®] and PGA RESORBA[®] come from in-vitro experiments, whereas the data of CAPROLON[®], PDO RESORBA[™] and PGA *resoquick*[™] come from in-vivo experiments. Thus, the curves are not directly comparable but serve as a simplified visual representation.

Principles

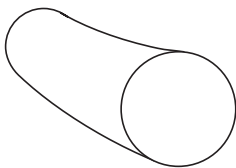
Thread structure

The structure of the suture affects its capillarity and how it moves through tissue. Current suture materials can be categorized into three main types, each offering specific advantages depending on the application.

Monofilament

A monofilament suture consists of a single thread filament. Its smooth surface makes it easier to pass through tissue and reduces the risk of bacterial colonization. Coatings on these sutures can improve smoothness, increase flexibility and enhance handling.

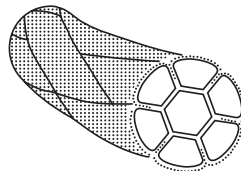
- GLYCOLON®
- CAPROLON® *
- PDO RESORBA™
- RESORBA® Barbed Suture
- MOPYLEN®
- MOPYLEN® CV
- RESOPREN®
- NYLON
- RESOLON®
- STAINLESS STEEL



Multifilament - coated

A multifilament suture is composed of numerous fine individual filaments, either twisted together or braided into filament bundles. To enhance mechanical properties, multifilament sutures can be treated with specific coatings. This process fills the gaps within the filament bundles and reduces surface friction.

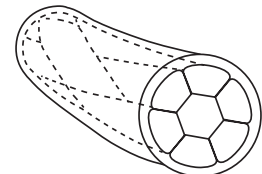
- PGA resoquick™
- PGA RESORBA®
- POLYESTER
- SUPOLENE
- SILK



Pseudo-monofilament

Pseudo-monofilament sutures combine features of both monofilament and multifilament sutures. They consist of multifilament bundles arranged in parallel and enclosed in a smooth sheath, giving them the appearance and feel of monofilaments.

- SUPRAMID



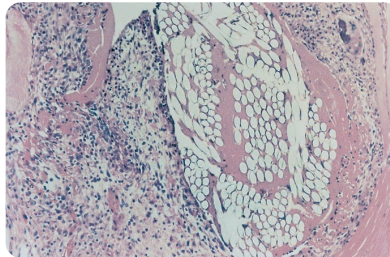
Tissue acceptance

Every insertion of suture will trigger some tissue reaction within the body (see the table below).

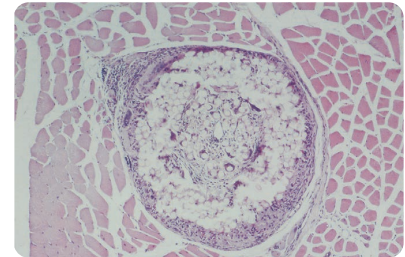
The causes are:

- ▶ Traumatization of tissue on placing the suture
- ▶ Mechanical irritation of the suture's surface which cannot be avoided but reduced when using monofilament threads
- ▶ Natural immunological reaction (nonspecific foreign-body reaction and defence reaction against chemistry of the thread)

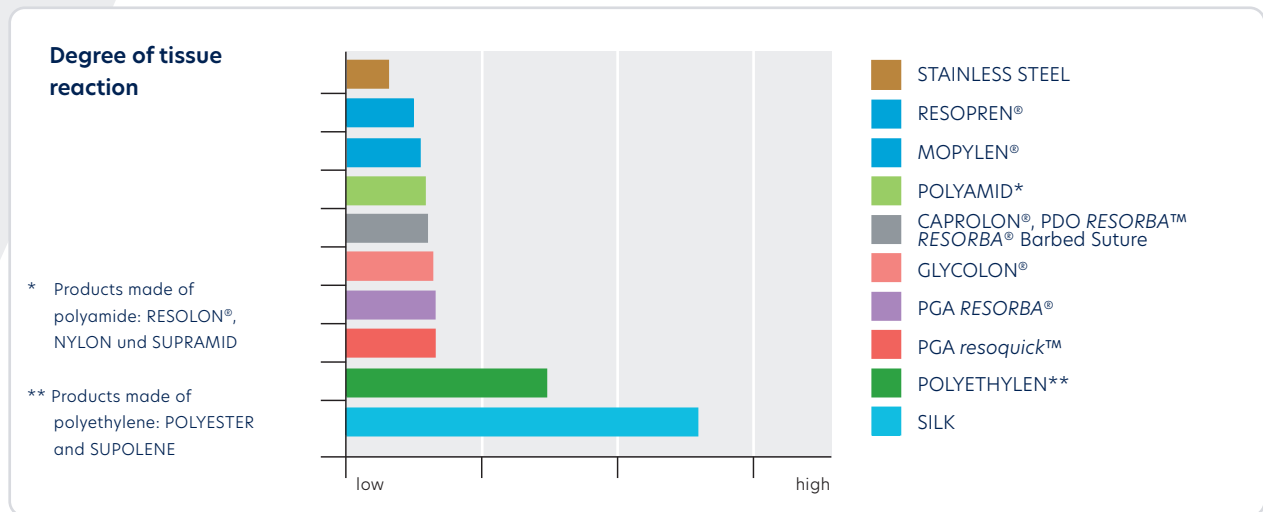
Using PGA RESORBA® as example



Microscopy of section through an intramuscular implant, **7 days post-operative**. Expectedly mild cellular infiltration is visible.



Microscopy of section through an intramuscular implant, **14 days post-operative**. The suture is embedded within the block of tissue. No evidence of either tissue reaction or encapsulation.



Principles

Thread table

Diameter of sutures

The harmonised standards as derived from the monographs of the European Pharmacopoeia (Ph. Eur.), have established the metric classification and nomenclature for suture diameter

which are mandatory for European manufacturers. The table compares the diameters with the conventional nomenclature used to date (United States Pharmacopeia). The latter has no direct connection to thread

diameter so that they cannot be derived from them. In contrast, the metric EP numbers can be converted into a thread diameter: 1 metric corresponds to a thread diameter of 0.1 mm.

Ph.Eur.	Diameter range in mm	PGA RESORBA®	PGA resorquick™	MOPYLEN®	MOPYLEN® CV	RESOPREN®	POLYESTER	SUPOLENE	NYLON monofilament	RESOLON®	SUPRAMID	SILK	STAINLESS STEEL monofilament	Synth monofilament Diameter range in mm	GLYCOLON®	CAPROLON®	PDO RESORBA™	RESORBA® Barbed Suture
0.1 EP	0,010-0,019	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
0.2 EP	0,020-0,029	-	-	10-0	-	-	-	-	10-0	-	-	-	-	-	-	-	-	-
0.3 EP	0,030-0,039	-	-	9-0	-	-	-	-	9-0	-	-	-	-	-	-	-	-	-
0.4 EP	0,040-0,049	8-0	-	8-0	8-0	-	-	-	8-0	-	-	8-0	-	-	-	-	-	-
0.5 EP	0,050-0,069	7-0	-	7-0	7-0	7-0	-	-	7-0	7-0	-	7-0	-	0,050-0,094	-	7-0	7-0	-
0.7 EP	0,070-0,099	6-0	6-0	6-0	6-0	6-0	6-0	6-0	6-0	6-0	6-0	6-0	-	0,095-0,149	6-0	6-0	6-0	-
1 EP	0,100-0,149	5-0	5-0	5-0	5-0	5-0	5-0	5-0	5-0	5-0	5-0	5-0	5-0	0,150-0,199	5-0	5-0	5-0	-
1.5 EP	0,150-0,199	4-0	4-0	4-0	4-0	4-0	4-0	4-0	4-0	4-0	4-0	4-0	4-0	0,200-0,249	4-0	4-0	4-0	4-0
2 EP	0,200-0,249	3-0	3-0	3-0	3-0	3-0	3-0	3-0	3-0	3-0	3-0	3-0	3-0	0,250-0,339	3-0	3-0	3-0	3-0
2.5 EP	0,250-0,299	-	2-0	-	-	-	-	-	-	-	2-0	-	-	-	-	-	-	-
3 EP	0,300-0,349	2-0	2-0	2-0	2-0	2-0	2-0	2-0	2-0	2-0	2-0	2-0	2-0	0,340-0,399	2-0	2-0	2-0	2-0
3.5 EP	0,350-0,399	0	0	0	0	0	0	0	0	0	0	0	0	0,400-0,499	0	0	0	0
4 EP	0,400-0,499	1	1	1	-	1	1	1	1	1	1	1	1	0,500-0,570	1	1	1	1
5 EP	0,500-0,599	2	2	2	-	2	2	2	2	-	2	2	2	0,571-0,610	-	2	2	-
6 EP	0,600-0,699	3+4	-	-	-	-	3+4	3+4	-	-	-	3+4	3+4	-	-	-	-	-
7 EP	0,700-0,799	5	-	-	-	-	5	-	-	-	-	5	5	-	-	-	-	-
8 EP	0,800-0,899	-	-	-	-	-	6	-	-	-	-	-	6	-	-	-	-	-
9 EP	0,900-0,999	-	-	-	-	-	-	-	-	-	-	-	7	-	-	-	-	-

Tensile strength of surgical suture

Tensile strength is defined as the force required in Newton (N) to break a knot in a suture.

Since the tensile strength of a knot is decisive in surgical practice (it is necessarily less than with a linear pull), this is the only measure which is defined in official requirements. In relevant tests the thread is knotted once before the force is applied.



Requirements on the tensile strength according to Pharm.Eur.*
(harmonised standards)

Diameter metric	All other non-absorbable sutures in [N]	Synthetic multifilament absorbable sutures (PCA RESORBA®) in [N]	Synthetic monofilament absorbable sutures (PDO RESORBA™) in [N]
0.2 metric	0.10	-	
0.3 metric	0.35	-	
0.4 metric	0.60	0.70	
0.5 metric	1.00	1.4	1.40
0.7 metric	1.50	2.5	2.50
1 metric	3.00	6.80	6.80
1.5 metric	5.00	9.50	9.50
2 metric	9.00	17.50	17.50
2.5 metric	13.00	-	-
3 metric	15.00	26.80	26.80
3.5 metric	22.00	39.00	39.00
4 metric	27.00	50.80	50.80
5 metric	35.00	63.50	63.50
6 metric	50.00	-	-
7 metric	62.00	-	-
8 metric	73.00	-	-

*Minimum mean value from 5 tests

Surgical needles

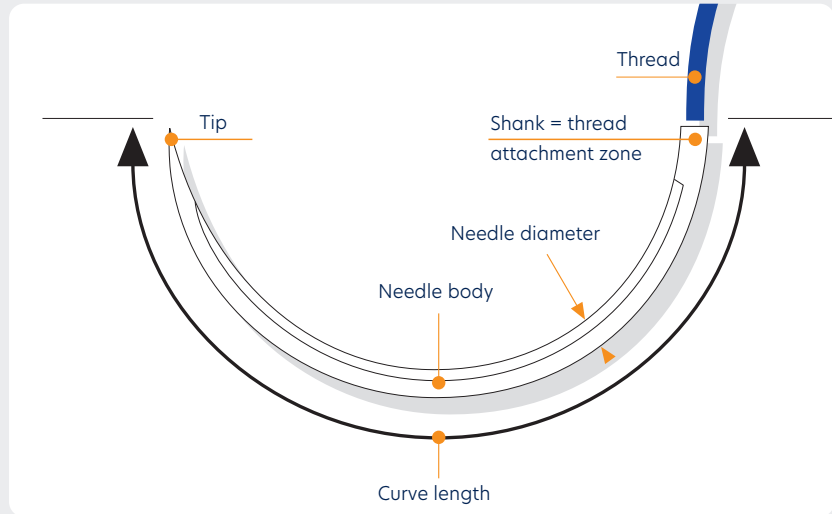
Characteristics & shapes

The characteristics of a needle

(diameter, point, length of needle curvature) should always be optimally suited to the particular indication, surgical technique and tissue conditions. The parameters to be considered are:

- Response to penetration (on insertion and pulling through of the needle)
- Resistance to bending
- Resistance to breaking
- Secure positioning in needle-holder

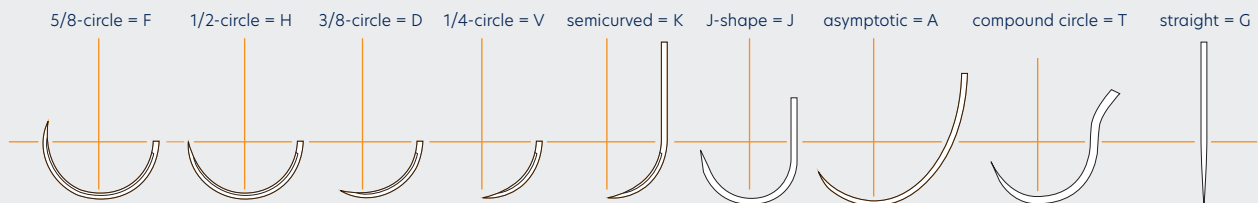
For suturing and suture encircling of wounds, atraumatic (eyeless) needles are usually used as needle-thread combinations. Needle-thread combinations mean that the thread is inserted and firmly anchored inside a drilled shaft at the end of the needle. This provides an essentially stepfree transition from thread to needle. Any further trauma to tissue is avoided



and trauma could occur if the thread is doubled up after passing it through the eye of a needle. RESORBA® eyeless needles are made from special stainless steel with optimal flexibility and strength. Special surface treatment and precision grinding of the point or edge ensure minimal resistance on

insertion and easy passage of the needle through the tissue. The firmness with which the needle is attached to the suture is tested in accordance with the regulations of harmonised standards for surgical suturing materials according to the European Pharmacopoeia.

The needle shapes:



Cross-sections and points



Spatula needle □ = P

1/2 circle, 3/8 circle, 1/4 circle, or straight
= HSPM, DSPM, VSPM

- ▶ For use in ophthalmic surgery and microsurgery
- ▶ Needle cross-section flattened
- ▶ PREMIUM cut
- ▶ Cuts on lateral edges



Reverse cutting needle ▼ = S

1/2 circle, 3/8 circle, semicurved or straight
= HS, DS, KS, GS

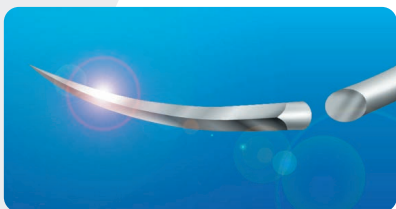
- ▶ For use in firm tissue such as skin
- ▶ Triangular needle cross-section
- ▶ Also available with PREMIUM cut needles M



Inner cutting needle ▲ = SI

1/2 circle, 3/8 circle
= HSI, DSI

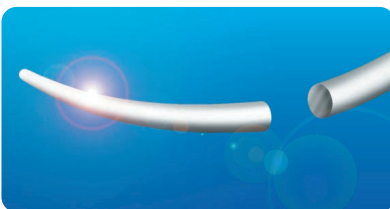
- ▶ For use in firm tissue such as skin
- ▶ Triangular needle cross-section
- ▶ Also available with PREMIUM cut needles M



Round-bodied cutting needle ▼ = RT

1/2 circle, 3/8 circle, J-shaped, asymptotic or straight = HRT, DRT, JRT, ART, GRT

- ▶ For use in firm tissue, sclerotic vessels, and implants
- ▶ Needle tip triangular in section



Blunt, round-bodied needle ○ = RN

1/2 circle, 3/8 circle or semicurved
= HRN, DRN, KRN

- ▶ For use in parenchymal tissue, the cervix, and muscle traction in the eye
- ▶ Needle tip blunt
- ▶ No puncturing of vessels or tendons



Round-bodied needle ● = R

5/8 circle, 1/2 circle, 3/8 circle, compound circle, J-shaped or straight
= FR, HR, DR, TR, JR, GR

- ▶ For use in soft tissue (subcutaneous) such as muscle, fascia, mucosa
- ▶ In order to improve grip by the needle holder, the cross-section of the middle part of the needle is flattened
- ▶ Easy insertion

Surgical needles

Needle code

1. letter: Indicates the curvature of the needle

- F = 5/8 circle
- H = 1/2 circle
- D = 3/8 circle
- V = 1/4 circle
- K = semicurved
- J = J-shaped
- A = asymptotic
- T = compound circle
- G = straight

2. letter: Gives information on the type of needle and needle tip

- R = round bodied needle
- S = reverse cutting needle

3.+4. letters: Describe special features of the needle and needle tip

- I = conventional cutting
- M = PREMIUM cut (partly hand-honed)
- N = blunt point
- T = trocar point
- P = spatulated needle
- S = stronger diameter
- X = extra strong diameter
- F = thin PREMIUM cut "THIN LINE" (partly hand-honed)
- W = flexible needle

Numbers indicate the straight (extended) length of the needle in mm

- S (after number) = stronger diameter
- F (after number) = extra thin diameter

H R X 30

Control release needles

To save time, e.g. when inserting single knot sutures for anastomoses of the gastrointestinal tract or layered wound closure, the needle-thread combination has been constructed with a removable needle.

After the suture has been placed, the needle can be removed from the suture with a slight pull. There is no need to adjust the scissors and cutting the needle from the thread.

Table of materials

Trade name	Raw material	Structure	Thread diameter metric	Thread diameter USP	Colour	Absorption profile
PGA <i>resoquick</i> ™	Polyglycolic acid, coated	multifilament/ braided	0.7 to 5 metric	USP 6-0 to 2	undyed	short term
GLYCOLON®	Polyglycolic acid-caprolactone	monofilament	0.7 to 4 metric	USP 6-0 to 1	violet, undyed	short term
PGA RESORBA®	Polyglycolic acid, coated	multifilament/ braided	0.4 to 7 metric	USP 8-0 to 5	violet, undyed	mid term
CAPROLON®	Poly(L-lactide-co-ε-caprolactone), coated	monofilament	0.5 to 5 metric	USP 7-0 to 2	violet, undyed	long term
PDO RESORBA™	Poly(p-dioxanone)	monofilament	0.5 to 5 metric	USP 7-0 to 2	violet	long term
RESORBA® Barbed Suture	Poly(p-dioxanone)	monofilament/ barbed	1.5 to 4 metric	USP 4-0 to 1	violet	long term
MOPYLEN®	Polypropylene	monofilament	0.2 to 5 metric	USP 10-0 to 2	blue	
MOPYLEN® CV	Polypropylene	monofilament	0.4 to 3.5 metric	USP 8-0 to 0	blue	
RESOPREN®	PVDF	monofilament	0.5 to 5 metric	USP 7-0 to 2	blue	
POLYESTER	Polyester, coated	multifilament/ braided	0.7 to 8 metric	USP 6-0 to 6	green, white	
SUPOLENE	Polyester, coated	multifilament/ braided	0.7 to 6 metric	USP 6-0 to 3	green, white	
NYLON	Polyamide	monofilament	0.2 to 5 metric	USP 10-0 to 2	black, white	
RESOLON®	Polyamide	monofilament	0.5 to 4 metric	USP 7-0 to 1	blue	
SUPRAMID	Polyamide	pseudo- monofilament	0.7 to 5 metric	USP 6-0 to 2	black, white	
SILK	Silk fibroin, coated	multifilament/ braided	0.4 to 6 metric	USP 8-0 to 5	black	
STAINLESS STEEL	Stainless steel	monofilament	1 to 9 metric	USP 5-0 to 7	nature	

Multifilament, short-term absorbable suture

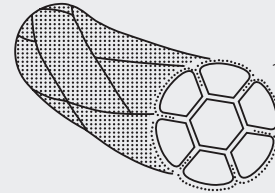
PGA resoquick™

PGA resoquick™ is a high molecular weight, linear homopolymer of glycolic acid (hydroacetic acid), which is extruded into thin filaments and braided into sutures of various diameters.

Metabolisation of the PGA suture within the tissue occurs by the uptake of water, thus reversing the synthesis. The monomeric glycolic acid is split enzymatically into CO₂ and H₂O by the normal metabolism. The fine, precision braided filaments guarantee a very high tensile strength - as well as great suppleness. The special coating of a mixture of calcium stearate & polycaprolactone thinly covers the fibre bundles for specific reduction of surface friction. Absorbable suture approximates the tissue during the healing phase and progressively loses its tensile strength and breaking load.

The precision braided filaments of polyglycolic acid that make up PGA resoquick™ ensure standardized and moderately rapid absorption in tissue. PGA resoquick™ is absorbed rather quickly than PGA RESORBA® because this material is manufactured using a lower molecular weight PGA. The molecular weight of the PGA material is reduced during a special heat treatment process of the thread before coating.

After only seven days PGA resoquick™ has already lost 56 % of its original breaking load. After 14 days all original breaking load is lost completely. Absorption of PGA resoquick™ is approximately completed after 42 days.



Properties

- ✓ very supple
- ✓ very high tensile strength
- ✓ minimal tissue reaction
- ✓ smooth passage through tissue
- ✓ high knot security

- ▶ **Colour:** undyed
- ▶ **Chemical name:** polyglycolic acid
- ▶ **Thread diameter:** USP 6-0 - 2 (0.7-5 metric)
- ▶ **Types of packaging:**
 - needle-thread-combinations
 - precut lengths
- ▶ **Sterilization method:** ethylene oxide

Monofilament, short-term absorbable suture

GLYCOLON®

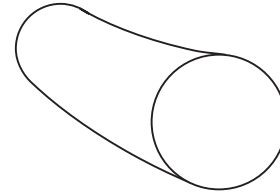
The production of GLYCOLON® involves the copolymerisation of polyglycolic acid and ϵ -caprolactone in a certain ratio.

The breakdown of the polymeric suture in the tissue occurs through water uptake, thereby reversing the synthesis.

The strength of GLYCOLON® reduces to 30 % after 7 days. The completely safe intermediary products that are formed, as well as the smooth, monofilament surface structure of the thread, result in minimal tissue reaction.

The smooth, monofilament surface structures of the polymer give GLYCOLON® excellent handling and tissue passage properties. Tissue trauma as a result of suturing is not relevant to GLYCOLON®, and the monofilament structure prevents wicking of the thread without the need for additional surface treatment.

GLYCOLON® is available undyed, especially suitable for skin closure, and in violet (coloured with the physiologically harmless D+C No. 2 dye).



Properties

- ✓ high tear resistance
- ✓ excellent knot security
- ✓ atraumatic tissue passage

- ▶ **Colour:** undyed or violet
- ▶ **Chemical name:** poly(glycolic acid-co- ϵ -caprolactone)
- ▶ **Thread diameter:** USP 6-0 - 1 (0.7-4 metric)
- ▶ **Types of packaging:**
 - needle-thread-combinations
 - precut lengths
- ▶ **Sterilization method:** ethylene oxide

Multifilament, medium-term absorbable suture

PGA RESORBA®

PGA RESORBA® is a polymer of glycolic acid. The linear, high molecular weight polyglycolic acid is synthesised in the presence of a catalyst via the intermediary product glycolide, a cyclic ester. The breakdown of the PGA suture in the tissue occurs through water uptake, thereby reversing the synthesis. Regular metabolic processes break down the glycolic acid monomers into CO₂ and H₂O through enzymatic degradation.

The physical and physiological properties of suture material containing 10 % lactide as copolymer differ only slightly from pure PGA sutures.

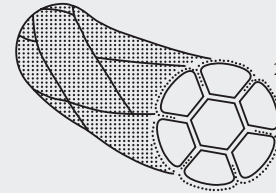
The thin, precision-braided filaments provide very high tear resistance as well as excellent suppleness.

The special coating thinly encapsulates the fibre bundles resulting in a specific reduction of surface friction.

Absorbable sutures approximate the tissue during the healing phase; at the same time, they increasingly lose their tensile strength and tear resistance.

PGA RESORBA® contains precision-braided filaments made of polyglycolic acid that result in a standardised, moderate rate of absorption in the tissue. Depending on the thread diameter 50 % of the original tensile strength of PGA RESORBA® is lost after 18 days.*

Violet PGA RESORBA® is coloured with a physiologically harmless dye.



Properties

- ✓ high tear resistance
- ✓ good handling
- ✓ excellent knot security
- ✓ atraumatic tissue passage
- ✓ minimal tissue reaction

- ▶ **Colour:** violet or undyed
- ▶ **Chemical name:** polyglycolic acid
- ▶ **Thread diameter:** USP 8-0 - 5 (0.4-7 metric)
- ▶ **Types of packaging:**
 - needle-thread-combinations
 - precut lengths
- ▶ **Sterilization method:** ethylene oxide

Monofilament, long-term absorbable suture

CAPROLON®

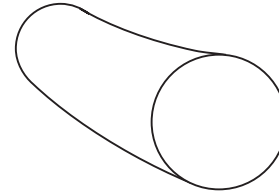
In the manufacture of CAPROLON® its two components, lactide and ϵ -caprolactone, are co-polymerised in a fixed proportion. This creates poly(L-lactide-co- ϵ -caprolactone).

Because of its high lactide proportion, CAPROLON® is classified among the slowly absorbed suture materials. After implantation the breaking load of CAPROLON® decreases by about half after 7 weeks. Complete absorption by hydrolysis is completed after about 25 weeks.

Tissue reaction is minimal because of the completely safe intermediary products and the monofilament structure of the thread.

CAPROLON® is coated with a blend of calcium stearate and a copolymer of L-lactide and ϵ -caprolactone, enhancing handling and tissue glide.

CAPROLON® is supplied undyed for skin sutures or violet.



Properties

- ✓ very high tensile strength
- ✓ minimal tissue reaction
- ✓ smooth passage through tissue
- ✓ robust and high knot security

- ▶ **Colour:** violet or undyed
- ▶ **Chemical name:** poly(L-lactide-co- ϵ -caprolactone)
- ▶ **Thread diameter:** USP 7-0 - 2 (0.5-5 metric)
- ▶ **Types of packaging:** needle-thread-combinations
- ▶ **Sterilization method:** ethylene oxide

Monofilament, long-term absorbable suture

PDO RESORBA™

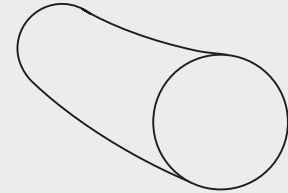
PDO RESORBA™ is made of the poly-ester poly(p-dioxanone). Because of its slow degradation profile, PDO RESORBA™ is particularly useful where the combination of an absorbable suture and extended wound support (up to six weeks) is desirable.

After implantation the breaking load is at 50 - 60 % after 42 days. Absorption by hydrolysis is completed after about 180 to 220 days

Tissue reaction is minimal because of the monofilament structure of the thread.

PDO RESORBA™ is supplied violet.

- ▶ **Colour:** violet
- ▶ **Chemical name:** poly(p-dioxanone)
- ▶ **Thread diameter:** USP 7-0 - 2 (0.5-5 metric)
- ▶ **Types of packaging:** needle-thread-combinations
- ▶ **Sterilization method:** ethylene oxide



Properties

- ✓ very high tensile strength
- ✓ minimal tissue reaction
- ✓ smooth passage through tissue
- ✓ robust and high knot security

Monofilament, long-term absorbable suture

RESORBA® Barbed Suture

RESORBA® Barbed Suture (PDO) is a polydioxanone knotless tissue-closure device, which is comprised of barbed dyed polydioxanone (PDO) suture material, armed with a surgical needle on one end and an end stopper at the other end.

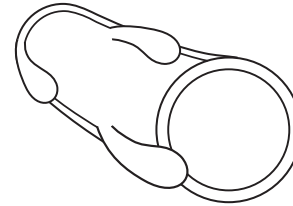
RESORBA® Barbed Suture (PDO) features unidirectionally oriented barbs that facilitate tissue approximation without the need for tying surgical knots.

Although the barbs in the RESORBA® Barbed Suture (PDO) reduce tensile strength compared to non-barbed suture material of the same size, tying

knots in non-barbed sutures also diminishes their effective strength. For this reason, the strength of the RESORBA® Barbed Suture (PDO) can be compared to USP knot strength of non-barbed sutures.

After implantation, the tensile strength remains at 55 % after 42 days. Absorption by hydrolysis is completed after about 180 to 220 days.

RESORBA® Barbed Suture (PDO) is available in violet (coloured with the physiologically harmless D+C No. 2 dye).



Properties

- ✓ siliconised needles made of 300 steel
- ✓ synthetic with a long period of action
- ✓ unidirectional spiral angle cut on one side
- ✓ high tensile strength
- ✓ triangular end stopper

- ▶ **Colour:** violet
- ▶ **Chemical name:** poly(p-dioxanone)
- ▶ **Thread diameter:** USP 4-0 - 1 (1.5-4 metric)
- ▶ **Types of packaging:** needle-thread-combinations
- ▶ **Sterilization method:** ethylene oxide

USP strength before barbed suture	USP strength of RESORBA® Barbed Suture	Number of barbs per inch
2	1	32
1	0	33
0	2-0	42
2-0	3-0	51
3-0	4-0	54

Non-absorbable suture

MOPYLEN®

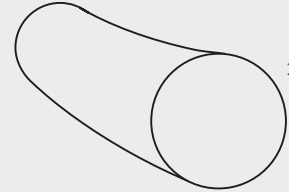
MOPYLEN® is a synthetic suture, which is manufactured by polymerising propylene.

The suture is produced from the dyed granules using the dry spinning process. The suture is hydrophobic, meaning it absorbs practically no water and is chemically inert.

MOPYLEN® is an ideal skin suture, especially in plastic surgery and anywhere, where an excellent cosmetic result is critical.

The material is coloured with a physiologically harmless dye.

- ▶ **Colour:** blue
- ▶ **Chemical name:** isotactic polypropylene
- ▶ **Thread diameter:** USP 10-0 – 2 (0.2-5 metric)
- ▶ **Types of packaging:** needle-thread-combinations
- ▶ **Sterilization method:** ethylene oxide



Properties

- ✓ excellent knot security
- ✓ consistently high tear resistance
- ✓ excellent tissue passage
- ✓ hydrophobic
- ✓ non-ageing

Dry Spinning Process:

The dry spinning process is a manufacturing technique for producing synthetic fibers, where a polymer is dissolved in a solvent and extruded into the air through a spinneret. The solvent then evaporates, resulting

in the formation of solid fibers. This method is commonly used in the production of surgical sutures and allows for the creation of threads with specific properties, such as high strength and biocompatibility.

Non-absorbable suture

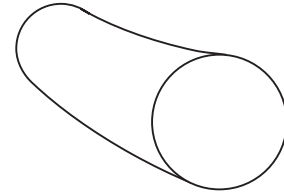
MOPYLEN® CV

MOPYLEN® CV is a special suture for cardio-vascular surgery and is crimped exclusively with SURE POINT needles.

MOPYLEN® CV is a synthetic suture, which is manufactured by polymerising propylene. The suture is produced from the dyed granules using the dry spinning process. The suture is hydrophobic, i.e., it absorbs practically no water and is chemically inert. The material is dyed with a physiologically harmless dye.

To reduce the memory effect, USP thicknesses 6/0 and thinner are produced in long packs.

- ▶ **Colour:** blue
- ▶ **Chemical name:** isotactic polypropylene
- ▶ **Thread diameter:** USP 8-0 – 0 (0.4-3.5 metric)
- ▶ **Types of packaging:** needle-thread-combinations
- ▶ **Sterilization method:** ethylene oxide



Properties

- ✓ excellent knot security
- ✓ consistently high tear resistance
- ✓ excellent tissue passage
- ✓ non-ageing
- ✓ SURE POINT needles for optimised use within cardio-vascular surgery

Memory Effect:

The memory effect refers to the property of surgical sutures to retain their shape, such as bends or kinks, after being removed from

the packaging. This effect can be mitigated by gently stretching the suture material.

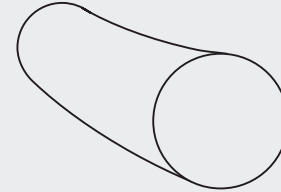
Non-absorbable suture

RESOPREN®

RESOPREN® is a blue, monofilament, synthetic suture made of polyvinylidene difluoride (PVDF). The suture is produced from the dyed granules using the dry spinning process. RESOPREN® is chemically inert, hydrophobic and highly resistant to ageing.

The material is coloured with a physiologically harmless dye.

- ▶ **Colour:** blue
- ▶ **Chemical name:** polyvinylidene difluoride
- ▶ **Thread diameter:** USP 7-0 - 2 (0.5-5 metric)
- ▶ **Types of packaging:** needle-thread-combinations
- ▶ **Sterilization method:** ethylene oxide



Properties

- ✓ hydrophobic, flexible and elastic
- ✓ excellent tissue passage
- ✓ extremely supple
- ✓ chemically inert
- ✓ extremely resistant to ageing

Information that is applicable to all the synthetic sutures described:

Due to their elasticity coupled with a relatively high tensile strength, no synthetic sutures should be too tightly knotted to ensure low tension within the tissue. Excessively high tension within the tissue may lead to wound healing disturbance, or even necrotic reactions. In view of the elastic stretch and smooth surface (especially of mono-

filament sutures), it is recommended that an additional knot is made to ensure that the knot sits very firmly. According to Nockemann* it is best "first to place a Surgeon's or Friction Knot and then a Square Knot over it for safety". In principle, synthetic sutures can be used universally for nearly all wounds.

Absorbable PGA *RESORBA*® has proven to be especially suitable for internal sutures, as for anastomoses, fascia sutures, subcutaneous tissues and ligatures. Monofilament polyamides such as *NYLON* and *RESOLON*®, as well as hydrophobic suture material such as *MOPYLEN*® and *RESOPREN*® are widely preferred for skin sutures.

Non-absorbable suture

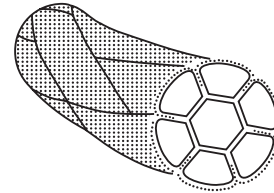
POLYESTER

POLYESTER is produced by polycondensation of ethylene glycol and terephthalic acid. Fibres are formed using the dry spinning process. Precision-braiding and tempering transform the stretched, slightly twisted fibre bundles into a suture.

The individual fibres are hydrophobic, meaning they repel water.

The material is coloured with a physiologically harmless dye.

- ▶ **Colour:** green, white (no dye)
- ▶ **Chemical name:** polyethylene terephthalate polyester fibre
- ▶ **Thread diameter:** USP 6-0 – 6 (0.7-8 metric)
- ▶ **Types of packaging:**
 - needle-thread-combinations
 - precut lengths
- ▶ **Sterilization method:**
ethylene oxide



Properties

- ✓ very high tear resistance
- ✓ excellent tissue passage
- ✓ high knot security

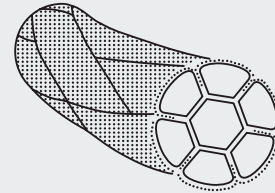
Non-absorbable suture

SUPOLENE

Like POLYESTER, the production of SUPOLENE involves the polycondensation of ethylene glycol and terephthalic acid. Fibres are formed using the dry spinning process. The suture then undergoes precision-braiding, dyeing and tempering and the surface is specially refined by coating. This surface treatment minimises capillarity and any sawing effect during tissue passage and knot rundown. SUPOLENE is hydrophobic, i.e., it does not absorb water.

The material is coloured with a physiologically harmless dye.

- ▶ **Colour:** green, white (no dye)
- ▶ **Chemical name:** polyethylene terephthalate polyester fibre
- ▶ **Thread diameter:** USP 6-0 - 3 (0.7-6 metric)
- ▶ **Types of packaging:**
 - needle-thread-combinations
 - in precut lengths
- ▶ **Sterilization method:** ethylene oxide



Properties

- ✓ high tear resistance
- ✓ excellent tissue passage, no sawing effect
- ✓ very even and smooth surface properties
- ✓ very minimal tissue reaction
- ✓ minimal capillarity

Non-absorbable suture

NYLON

NYLON is a monofilament extruded thread (pressed and drawn through dies in a malleable condition) made from polyamide 6-6.6.

Due to its high tensile strength, even at the smallest thread diameters, NYLON is particularly suited for the finest sutures in microsurgery. Polyamides can bind up to 10 % water. The material is coloured with a physiologically harmless dye.

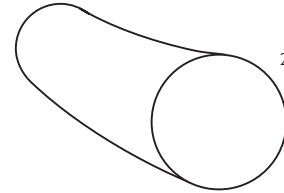
- ▶ **Colour:** white (no dye), black
- ▶ **Chemical name:**
polyamide 6-6.6
- ▶ **Thread diameter:** USP 10-0 - 2
(0.2-5 metric)
- ▶ **Types of packaging:**
needle-thread-combinations
- ▶ **Sterilization method:**
ethylene oxide

RESOLON®

RESOLON® is initially a monofilament polyamide 6-6.6 suture, like NYLON. However, it undergoes special treatment during the manufacturing process.

RESOLON® is exceptionally soft and supple even when dry and sterile. As a result, it has excellent handling and knotting properties for a monofilament suture, while ensuring maximum knot tear resistance.

- ▶ **Colour:** blue
- ▶ **Chemical name:**
polyamide 6-6.6
- ▶ **Thread diameter:** USP 7-0 - 1
(0.5-4 metric)
- ▶ **Types of packaging:**
 - needle-thread-combinations
 - precut lengths
- ▶ **Sterilization method:**
ethylene oxide



Properties

- ✓ above average softness and suppleness
- ✓ superior handling and knotting properties
- ✓ no capillarity
- ✓ excellent tissue passage

Non-absorbable suture

SUPRAMID

SUPRAMID is available as a monofilament, non-absorbable, surgical suture made from a copolymer of polyamide 6 and polyamide 6.6.

In larger diameters, it is supplied as a pseudo-monofilament, non-absorbable, surgical suture made from polyamide 6.6, a polymer of hexamethylenediamine and adipic acid with a polyamide-6 coating, a polymer of ϵ -caprolactam.

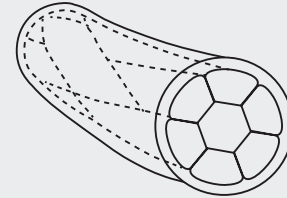
Special feature

Despite its synthetic origin and peptide-like structure, SUPRAMID gradually degrades after being in tissue for an extended period. Therefore, it is primarily suitable for

skin sutures or tissues that do not require permanent wound support, with few exceptions.

The material is coloured with a physiologically harmless dye.

- ▶ **Colour:** white (no dye) or black
- ▶ **Chemical name:**
 - monofilament: polyamide 6-6.6
 - pseudomonofilament: polyamide 6.6 and polyamide 6
- ▶ **Thread diameter:** USP 6-0 - 2 (0.7-5 metric)
- ▶ **Types of packaging:**
 - needle-thread-combinations
 - in precut lengths
- ▶ **Sterilization method:** ethylene oxide



Properties

- ✓ above average softness and suppleness
- ✓ superior handling and knotting properties
- ✓ no capillarity
- ✓ excellent tissue passage

Non-absorbable suture

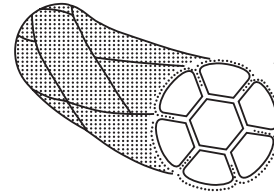
SILK

The raw material for silk production is the cocoon of the silkworm. The delicate filaments from these cocoons are degummed to remove sericin, then spun and precision-braided.

A surface treatment is applied to impregnate the silk filament, resulting in a silk that does not exhibit unwanted capillary action. This creates a non-capillary, water-repellent suture with a smooth surface.

SILK is coloured with a physiologically harmless dye.

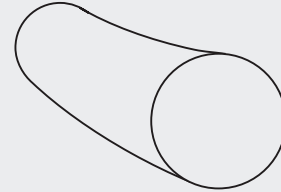
- ▶ **Colour:** black
- ▶ **Chemical name:** silk fibroin
- ▶ **Thread diameter:** USP 8-0 - 5 (0.4-6 metric)
- ▶ **Types of packaging:**
 - needle-thread-combinations
 - precut lengths
- ▶ **Sterilization method:** ethylene oxide



Properties

- ✓ very supple
- ✓ excellent knotting properties
- ✓ excellent knot security
- ✓ minimal sawing effect

Non-absorbable suture



STAINLESS STEEL

Steel wire is utilized in surgery for its exceptional tensile strength and outstanding corrosion resistance.

Made from stainless, high-strength steel alloys, it maintains its shape and functionality even under physiological conditions.

Manufacturing Process:

Liquid steel is drawn through specialized forming tools to produce wire in the desired diameters. This process ensures that the material is durable and biocompatible.

- ▶ **Chemical name:**
stainless steel
- ▶ **Thread diameter:** USP 5-0 - 7
(1-9 metric)
- ▶ **Types of packaging:**
 - needle-thread-combinations
 - precut lengths
- ▶ **Sterilization method:**
ethylene oxide

Properties

- ✓ high, unchanging tear resistance
- ✓ no stretching
- ✓ minimal tissue reaction
- ✓ no wicking effect

Manufacture of surgical suture

Using PGA RESORBA® as an example (multifilament, braided suture made from 100 % polyglycolic acid)

Raw material must comply with standard values governing diameter and knot tensile strength



The sutures are handmade



Packing in moisture-proof aluminium blisters



Testing of material

All supplied or self-produced raw materials and excipients are tested and selected according to international criteria before use.

Assembly / packing

We offer a wide range of product variants for different surgical indications. In addition to special needle-thread combinations, a multiplicity of customers' requests for specific applications are also met.

Sterilization

The products are sterilized with ethylene oxide.

Drying

PGA RESORBA®, made of polyglycolic acid fibres, reacts with H₂O. Drying of the suture after sterilization is an essential step in the manufacturing process to achieve high product safety.

Final testing

The special characteristic of PGA threads (breakdown by H₂O take-up) requires great care in packaging and packaging materials. This is achieved by the almost completely automatic production of blister packs. During the production process the metal foils and their seals are tested to ensure they are intact and tight.

All surgical sutures are manufactured and tested according to the stipulated legal regulations, which are:

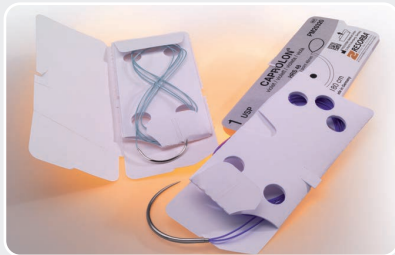
- European Pharmacopoeia (Ph. Eur.) and the harmonised norms derived from its monographs
- DIN ISO standards
- MDD 93/42/ EWG
- MDR (EU) 2017/745

The German rules and regulations governing pharmaceutical companies are based on the basic guidelines (European or international) of the World Health Organization (WHO) for the correct production of medicinal products and quality assurance according to GMP (Good Manufacturing Practice). The contents of these GMP guidelines largely agree with the European (Ph.Eur.) and the American Pharmacopoeia (USP). Since 14.6.1998, surgical suture material is defined solely in terms of the quality standards described in the DIN ISO or EN standard series. The CE marking allows for the sale across the entire European market (Harmonization at the European level).

Manufacture and packaging

Peel-eco-pack

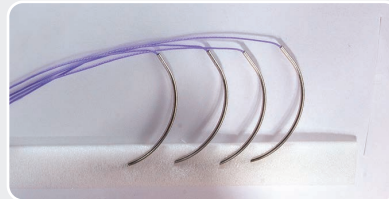
Sterile conditions and the use of contamination-free sutures are vital prerequisites for surgical work. This is guaranteed for our products by sterilizing them with ethylene oxide (EO) gas, and the safe combination of peelable outer and multifunctional inner wrappings.



The **peelable outer wrapping** can be opened by a non-sterile person (e.g. a Circulating Nurse in the operating room) by peeling it off so that the inner sterile contents can be safely passed on, assuring contamination-free transfer



The **multifunctional primary packet** further protects the suture and allows for problem-free and safe removal.



▶ **Sterile hand-over in the shortest time**
Quick and easy handling with approved suture primary packet.

▶ **Less packing material**
Reduction to two multifunctional wrapping units.

▶ **Environmentally friendly**
Primary packet made of recyclable paper.

▶ **Easy handling**
The layered arrangement of the atraumatic needles in the primary packet makes controlled and safe access possible.

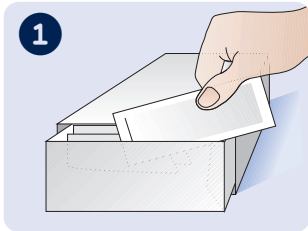
▶ **Memory effect**
The enlarged suture primary packet markedly reduces the memory effect when using monofilament suture material.

▶ **Separate withdrawal**
The primary packet in precut suture packs and multipacks makes it possible to withdraw single sutures.

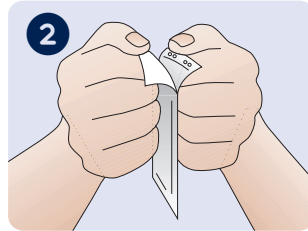
The eco-pack fulfils the provisions of DIN 58953, part 8 / Sterile supplies.

Peel-eco-pack

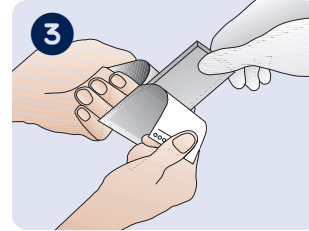
A combination of peelable outer wrapping and multifunctional primary packet



1
The peel-pack is removed from the storage box.

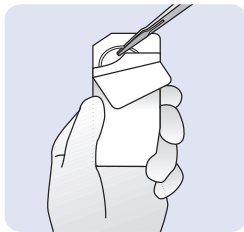


2
The Circulating Nurse grasps the two opening flaps at the upper end of the pack and opens it by evenly peeling the flaps apart.



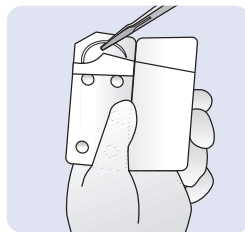
3
The sterile contents are handed over without contamination.

4 Handling of the primary packets:



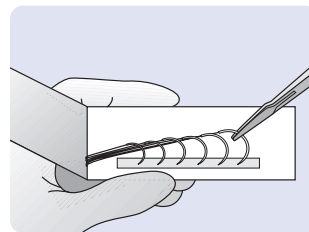
Single pack/needle-thread combination

Precut single sterile sutures with an attached surgical needle. The needle is exposed by turning over the perforated flap. It is then removed with a needle holder.



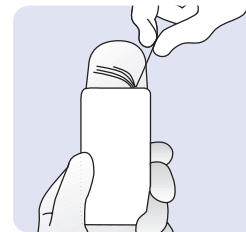
Single pack/needle-thread combination

The needle is exposed by folding out the suture carrier and then withdrawn with the needle holder.



Multipack

Several combinations in each sterile primary packet. This simplifies the organisation of handing over the same thread combinations during standardised procedures. The needles are exposed by opening the side of the paper cover, after which the individual needles (one after the other) are taken out with the needle holder.



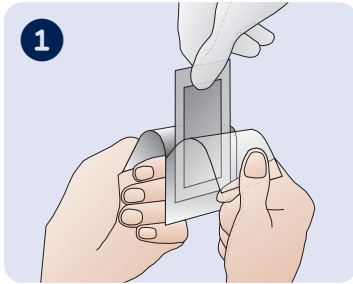
Precut sutures

One or more threads in each sterile primary packet. The suture is meant for ligatures or for use with eyed needles. After the upper flap has been opened, the individual threads can be withdrawn in any desired order.

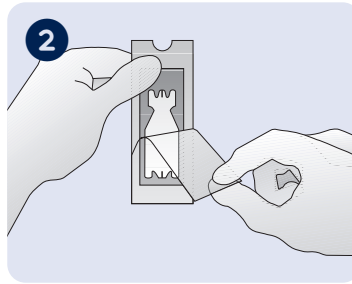
Manufacture and packaging

Micro-Pack

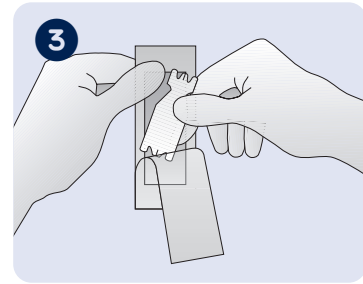
Primary packet with foam for micro- and ophthalmic surgery



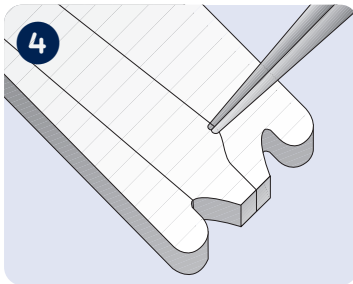
1 Peel open the non-sterile outer sachet and, without contamination, pass over the sterile inner sachet.



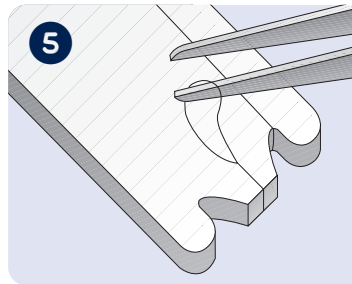
2 Peel open the inner sachet.



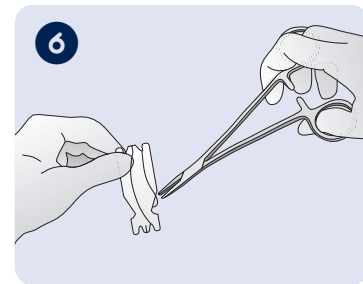
3 Carefully remove the sterile suture carrier from the blister sachet.



4 Before removing the needle, separate the thread from the carrier with forceps.



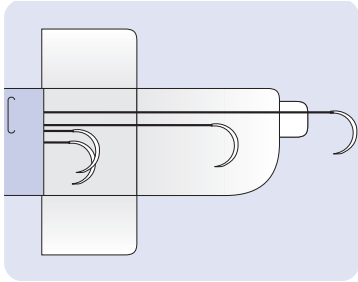
5 In the case of double-armed threads, firstly separate/cut the needle loop and then separate the thread from the carrier with forceps.



6 Grasp the needle with the needle holder and remove it from the primary packet by turning it slightly.

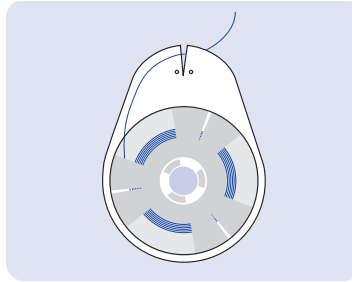
During the operation the needle can be "parked" in the sterile primary packet. After the operation the primary packet is used for depositing and checking the number of needles used.

Other types of packaging



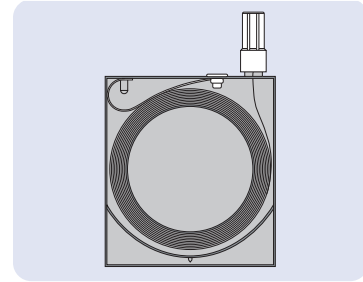
Multi-L-Pack

Special combinations are available in the Multi-L-Pack for preventing the memory effect. This ensures rapid, problem-free removal.



Ligature pack

Suture material of up to 4 m in length can be taken from a hand reel during an operation.

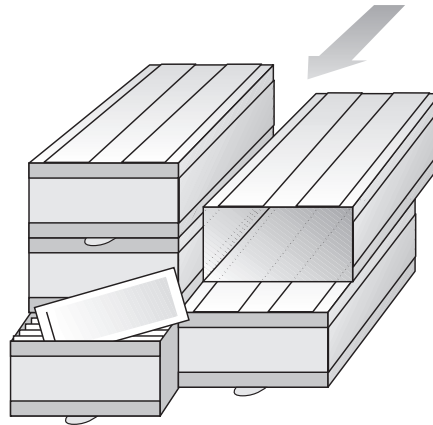


Dispenser packaging

Suture material can be removed aseptically from the dispenser. Suture material in so-called suture dispensers is predominantly used in veterinary medicine. The packaging is safe and economical.

Suture-boxes as organisational aids

Stacked boxes for storing standard suture material packages, for clearly organised arrangement in the operating room (can be stacked vertically and/or horizontally).



Organisational aids

Symbols used on the packaging

Absorbable suture material



dyed / braided / coated / absorbable

PGA RESORBA®



dyed / monofilament / absorbable

GLYCOLON®, PDO RESORBA™,
RESORBA® Barbed Suture



dyed / monofilament / coated / absorbable

CAPROLON®



undyed / braided / coated / absorbable

PGA resoquick™, PGA RESORBA®



undyed / monofilament / absorbable

GLYCOLON®



undyed / monofilament / coated / absorbable

CAPROLON®

Non-absorbable suture material



dyed / braided / coated / non-absorbable

POLYESTER, SUPOLENE, SILK



dyed / monofilament / non-absorbable

MOPYLEN®, MOPYLEN® CV, RESOPREN®,
NYLON, RESOLON®, SUPRAMID



dyed / twisted / coated / non-absorbable

SUPRAMID



undyed / braided / coated / non-absorbable

POLYESTER, SUPOLENE



undyed / monofilament / non-absorbable

NYLON, SUPRAMID, STAINLESS STEEL







undyed / twisted / coated / non-absorbable

SUPRAMID

Explanation of symbols

Symbols used for the chemical composition of synthetic sutures













PGA	PGA <i>resoquick</i> ™, PGA RESORBA®	Polyglycolic acid
PGA-PCL	GLYCOLON®	Poly(glycolide-co-caprolactone)
P(LA/CL)	CAPROLON®	Poly(L-lactide-co-ε-caprolactone)
PDO	PDO RESORBA™, RESORBA® Barbed Suture	Poly(p-dioxanone)
PP	MOPYLEN®, MOPYLEN® CV	Polypropylene
PVDF	RESOPREN®	Polyvinylidene difluoride
PET	POLYESTER, SUPOLENE	Polyester
PA	NYLON, RESOLON®, SUPRAMID	Polyamide

	control release needle		loop suture
	loop		ligature pack

Organisational aids

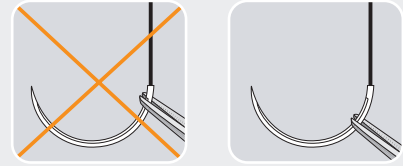
Did you know?

A short lesson in symbols used for medical products

	Reference number
	Batch number
	Use by year - month - day
	Consult instructions for use
	Do not reuse
	Do not resterilize
	Do not use if package is damaged
	Sterilized using ethylene oxide
	Upper limit of temperature
	CE marking with the identification number of the notified body responsible for certification. The four-digit-number (e.g. CE 0197) varies depending on the product's manufacturer and is assigned by the respective designated notified body. This marking indicates that the product complies with the European regulatory framework.*
	HIBC code
	Unique Device Identifier

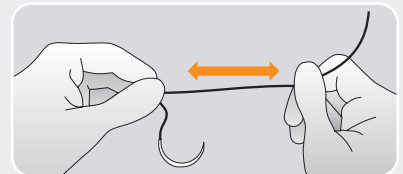
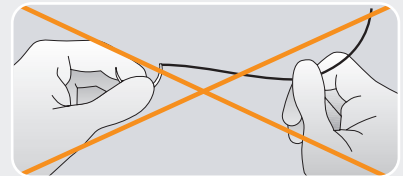
* Some of the products listed in this brochure are already certified under Regulation (EU) 2017/745 (MDR). Other products are currently undergoing the conformity assessment process. However, they remain legally compliant with Directive 93/42/EEC (MDD).

Holding the needle



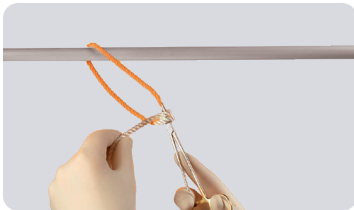
Needles should be held approx. 3/4 away from the tip. Do not clamp where the suture is swaged to the needle to avoid weakening the needle and suture.

Stretching the thread

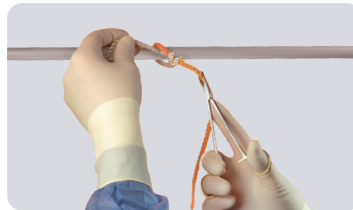


The thread must be stretched gently after it has been removed from the primary packet. Do not pull or rub it abruptly. Do not grasp the needle and stretch the thread!

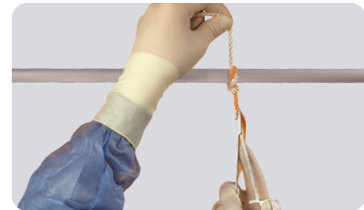
Knotting techniques: instrument knots



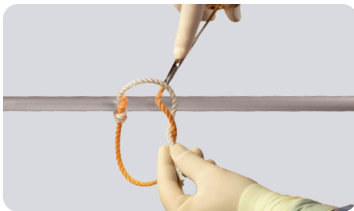
After you have penetrated the tissue with the needle, wrap the longer end of the suture around the needle holder. Then grasp the end of the suture slightly protruding from the wound.



Pull the short end of the suture through the throw towards yourself.



The first loop is fastened by pulling in opposite directions.



Now wrap the needle holder again with the long end of the suture and pull the needle holder in the opposite direction.



Tighten the knot carefully. Please note that closing the needle holder too tightly can damage the suture material.



Follow the instructions on the pictures to achieve this optimum configuration of the knots. Depending on the indication and suturing technique, it may be necessary to vary the number of throws.

¹ Product portfolio manufactured by:






Healthium Medtech Limited · #472-D, 13th Cross, 4th Phase
Peenya Industrial Area, Bangalore, Karnataka-560058, India
Email: care@healthiummedtech.com
Mfg. Lic. No.: MFG/MD/2021/000367

² Some combinations of this product portfolio manufactured by:

Healthium Medtech Limited · #472-D, 13th Cross, 4th Phase
Peenya Industrial Area, Bangalore, Karnataka-560058, India
Email: care@healthiummedtech.com
Mfg. Lic. No.: MFG/MD/2021/000367



FREIGABE/APPROVAL

Dokument-Nr. P1326 Datum 11.11.2024
 Revisionsstand: 2024-11
 Ersteller/Abt. Marketing
 Ersteller JA NEIN Sig. 
 RA JA NEIN Sig. 
 QA JA NEIN Sig. 
 Legal JA NEIN Sig. 
 Druckfreigabe JA NEIN Sig. 
 FOR_VA420510_0323 Stand: 26.05.2023

The RESORBA company was founded in September 1931 as a "Fabrik medizinischer Präparate" (a manufacturer of medical devices). Since then both the company and its products have undergone continual development.

Our company's main office on the outskirts of Nuremberg has provided the basis and capacity for us to continue to fulfil future demands in medicine competently and with a high level of quality.

