PERMACOL™
SURGICAL IMPLANT

HERE.
FOR 20 YEARS
HERE.
TO STAY
THE PATHWAY TO A MORE RELIABLE SURGICAL IMPLANT

1978
Research Starts at Dundee University – Roy Oliver and Roy Grant
2 Scientists

1990
Technology Platform Complete
1995
TSL (Leeds) purchase the IP – CE Mark achieved 1997

2000
First implantation for Complex Abdominal Wall repairs

2008
Covidien Purchase UK based TSL

2018
Permacol™ Surgical Implant 20th Anniversary

Here. For 20 Years Here. To Stay

Covidien
positive results for life

Medtronic
Further. Together
CHOOSING THE RIGHT MATERIAL IS KEY

HERE. TO HELP YOU CHOOSE THE RIGHT IMPLANT FOR YOUR PATIENT
THE VENTRAL HERNIA WORKING GROUP HAS CLASSIFIED DEFECTS IN GRADES

Grade 4: Infected
Presence of infection
Risk of infection

Grade 3: Potentially contaminated
Factors that suggest contamination include the presence of a nearby stoma, violation of the gastrointestinal tract, or history of wound infection

Grade 2: Low risk
includes patients who have comorbidities that increase the risk for surgical-site infection but who do not have evidence of wound contamination or active infection

Grade 1: Clean
No listed medical pathologies or co-morbidities
PERMACOL™ SURGICAL IMPLANT

HERE. FOR CONSISTENT RESULTS
### Functional matrix for guided tissue regeneration

<table>
<thead>
<tr>
<th></th>
<th>Description</th>
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<tbody>
<tr>
<td>1</td>
<td>Inert matrix while maintaining 3D Structure</td>
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<tr>
<td>2</td>
<td>Cells recognise matrix and respond appropriately</td>
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<tr>
<td>3</td>
<td>Durable enough to allow full maturation of host collagen</td>
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</table>
Crosslinked materials may prove more durable in the remodeling process as suggested by the increased thinning and weakening observed in non-crosslinked implant\textsuperscript{11}
Collagen is made up of polypeptide (amino acid) chains.

3 of these chains interact to form a collagen molecule.

5 of the collagen molecules interact to form microfibrils.

Microfibrils interact to form fibrils.

Natural crosslinking exists within native collagen to stabilize the protein structure, providing mechanical strength and natural durability.
It is a chemical reaction that generates links between molecules; usually these are covalent links (permanent)

Natural crosslinking exist within native collagen

Crosslinked materials may prove more durable in the remodeling process

Permacol™ Surgical Implant is crosslinked using HMDI to increase the stability of the protein and increase its resistance to degradation by collagenase enzymatic activity in vivo
“Collagen implants with minimal or no crosslinking can degrade so quickly that the scaffolds disappear before the host tissue can lay down its own extracellular matrix”¹

“The specific processing and degree of crosslinking is critical”¹
Collagenases are responsible for the breakdown and resorption of implanted collagen materials.

Crosslinked meshes exhibit increased resistance to collagenase activity and degradation whilst still allowing tissue in-growth.

Crosslinking of the acellular tissue increased its resistance against enzymatic attack.
Mesh durability may be the most important characteristic in determining optimal clinical outcomes.²¹²

**WHY CROSSLINK?**

**REASON 4**

The effect of crosslinking is to retard the degradation of the collagen by blocking collagenase binding site. It remains structurally intact for a longer period of time compared with non-crosslinked materials.⁹

**REASON 5**

Permacol™ had greater tensile strength than other crosslinked and non-crosslinked materials at 6 months.⁹

*Animal data is not necessarily indicative of human clinical outcomes*
Permacol’s™ crosslinked mesh does not hinder neovascularization or collagen ingrowth*¹¹

Permacol™ is durable and provided reinforcement at 12 months*¹¹

*Animal data is not necessarily indicative of human clinical outcomes
- **Permacol™** biologic implant maintained thickness while **Strattice™** thickness decreased significantly starting at 3 months*.11

- Tensile strength of **Permacol™** biologic implant was greater than **Strattice™** at 3, 6 and 12 months*.11

*Animal data is not necessarily indicative of human clinical outcomes
PERMACOL™ BIOLOGICAL IMPLANT HAS ACHIEVED OPTIMAL CROSSLINKING BY...

Proper crosslinking provides an optimal environment for the laying down of new collagen\(^1\)

- **Purification Platform**
- **20 yrs of R&D**
- **Cross linked with HMDI**
- **Protects and reinforces 3D triple helix from being broken down by collagenase**
Medtronic is grateful to Dr. Huang-Chien Liang and Professor Hsing-Wen Sung from the Department of Chemical Engineering, National Tsing Hua University, Hsinchu, Taiwan 30013 for their kind permission to use this image.

TISSUE REGENERATION PATTERN - IN VIVO PERFORMANCE CROSSLINKING vs NON CROSSLINKING

![Graph showing tissue regeneration pattern under different crosslinking percentages.](image-url)
Proud to HAVE...

<table>
<thead>
<tr>
<th>Feature</th>
<th>Permacol™ Surgical Implant</th>
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<tbody>
<tr>
<td>20 yrs of Product Development</td>
<td>✓</td>
</tr>
<tr>
<td>+15 yrs Clinical Data</td>
<td>✓</td>
</tr>
<tr>
<td>&gt;18 Month Human Explant Data</td>
<td>✓</td>
</tr>
<tr>
<td>5 yr data on remodelling of Permacol to host own tissue</td>
<td>✓</td>
</tr>
<tr>
<td>Long Term Results in Complex Abdomens</td>
<td>✓</td>
</tr>
<tr>
<td>Use in over &gt;450,000 procedures</td>
<td>✓</td>
</tr>
<tr>
<td>KOL’s with 20 yrs Experience</td>
<td>✓</td>
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WOUND HEALING

HERE. FOR THE MOST CHALLENGING ENVIRONMENTS
WOUND HEALING AND REMODELLING OF A CROSSLINKED IMPLANT IN A NON-CONTAMINATED FIELD

Progression of integration of implant\textsuperscript{12,13}
WOUND HEALING AND REMODELLING OF A CROSSLINKED IMPLANT IN A CONTAMINATED FIELD

Progression of integration of implant – unaffected by contaminated field $^{12,13}$
WOUND HEALING AND REMODELLING
OF A NON CROSSLINKED AND CROSSLINKED IMPLANT IN A CONTAMINATED FIELD$^{12}$
WOUND HEALING AND REMODELLING
NON-CROSSLINKED IMPLANT IN A CLEAN FIELD *12

Animal data is not necessarily indicative of human clinical outcomes
“Due to early degradation, no tissue regeneration was observed within fresh (without crosslinking) and the 30% degree crosslinking acellular tissues.

This is because the scaffolds provided by these two samples were already completely degraded before the infiltrated cells began to secrete their own extracellular matrix.”

1
“Recurrence rates were twice as for infected fields as for clean fields with Surgisis (12% vs. 6%, respectively) and Alloderm (22% vs. 10% respectively), but similar with Permacol™ biological Implant (4% vs. 5%, respectively).”\textsuperscript{10}
“Crosslinking does appear, at first glance, to improve early-term outcomes in infected field operations.”¹

“Non crosslinked Biologics are completely degraded after 6 months.”¹
Permacol™ surgical implant took 20 years to develop

Permacol™ surgical implant is optimally cross-linked for durability

Permacol™ surgical implant can perform in challenging environments

Permacol™ surgical implant has a wealth of clinical evidence

Permacol™ surgical implant can provide a durable repair
ANY QUESTIONS?


5. Use of Permacol™ surgical implant in a contaminated or infected field may lead to a weakening or breakdown of the implant. Treat any existing or suspected infection according to accepted medical practice before implanting the device. *IFU Permacol Surgical Implant*

6. It is the decision of the surgeon which device to use.


15. Breuing, K et al (20120, « Incisional ventral hernias: Review of the literature and recommendations regarding the grading and technique of repair », *Surgery*

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