UNIVERSITAS INDONESIA
Veritas, Probitas, Iustitia
EST. 1849
FAKULTAS KEDOKTERAN

RSCM

Stapling

The Science of Tissue Management


SUPERIOR PATIENT OUTCOMES
Tissue Management
Patient Management
Procedure Management

What is Tissue Management?

- Understanding the scientific properties of living tissue, and the relationship / interaction between living tissue and surgical instruments is the foundation upon which we develop our devices.

- We take full consideration of the impact surgical procedures have on tissue in the design and engineering of our devices in order to improve patient outcomes and advance healing.

Our Science of Tissue Management (SoTM) Philosophy

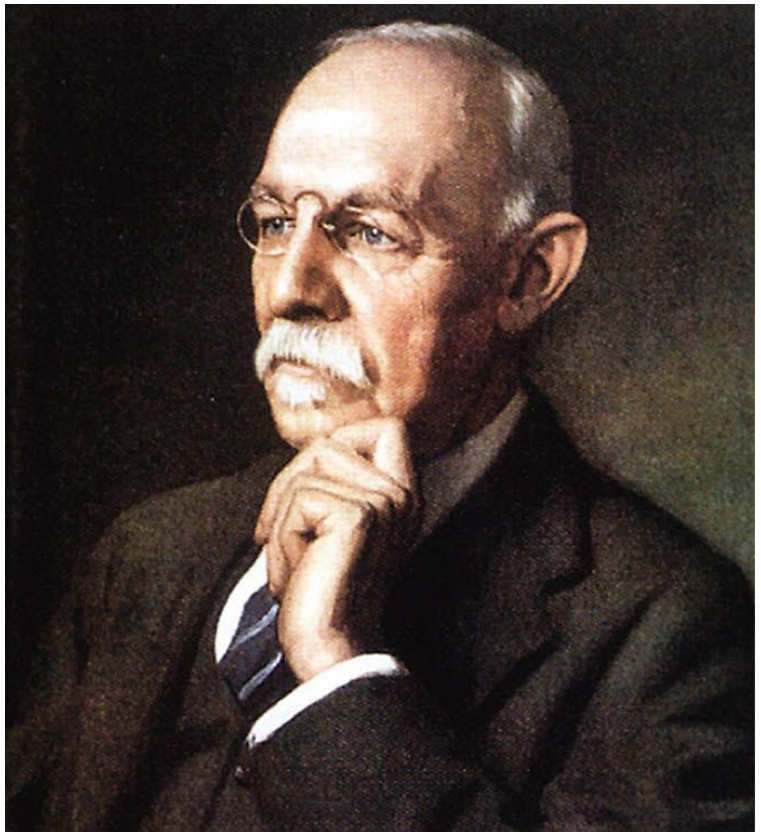
The principles for gently treating living tissue were established more than 100 years ago by Dr. William Halsted. Those principles haven't changed. However, with the evolution of surgery, techniques of interacting with tissue have become more complex.

For these reasons, we at Ethicon Endo–Surgery are constantly working to deepen the understanding of living tissue dynamics,
and to design our devices to help surgeons reduce trauma associated with their use.

Respect for living tissue lives at the heart of what we do.

Anastomotic Principles

- No tissue tension
- Leak–proof anastomosis
- Good hemostasis
- Adequate blood supply
- Adequate lumen



William S. Halsted, M.D.

Components of Tissue Management

Tissue Dynamics

Composition and biomechanics of living tissue

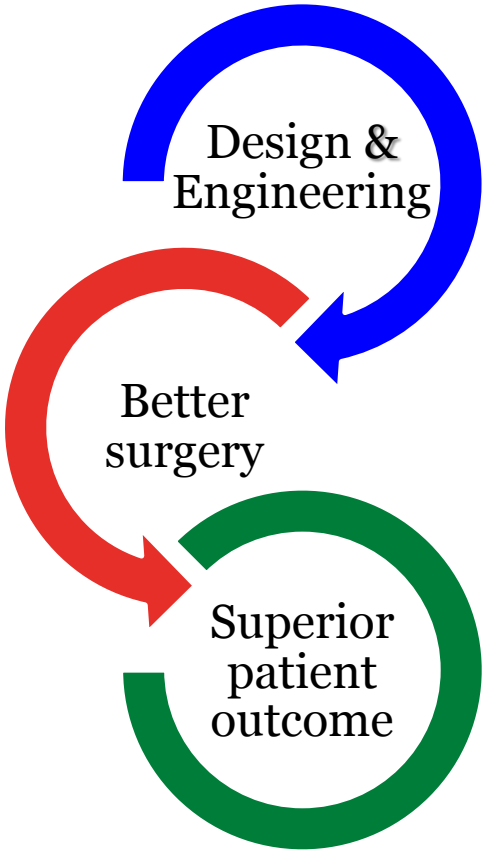
Technology

Device-tissue dynamic

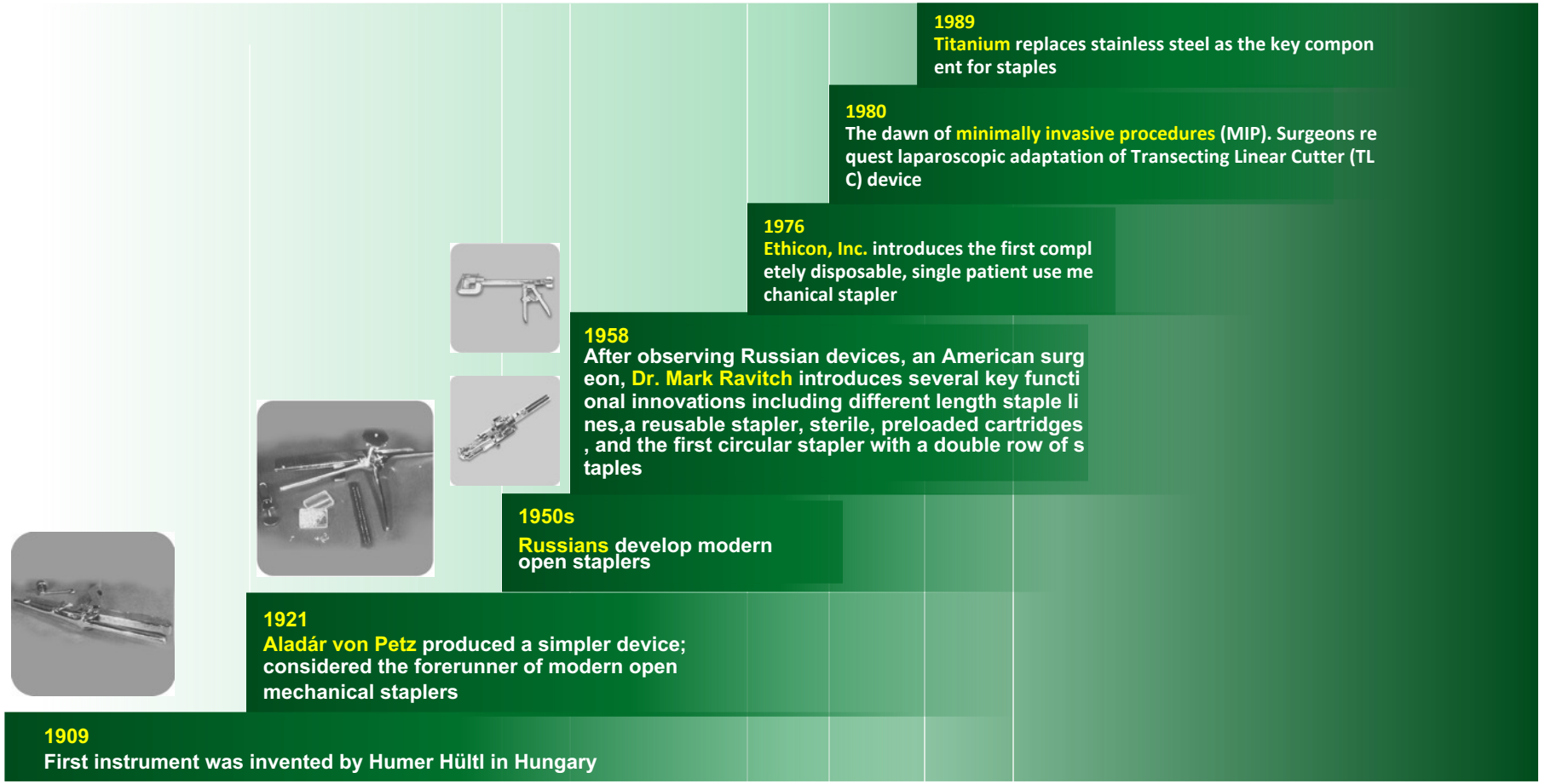
Human Factors

Human and device interactions

The Ethicon Approach



The Evolution of Surgical Stapling[1,2,3,4]



1. Baker RS, et al. *Obes Surg*. 2004;14:1290-1298.
2. Hardy KJ. *Aust N Z J Surg*. 1990;60(8):625-633
3. Astafiev GV. *Surgical Staplers* (*Chirurgicheskiey Shivayushiye Apparaty*). 1967;7 [translated from the Russian].
4. Baker RS, et al. *Obes Surg*. 2004;14:1290-1298.

The Function of Surgical Stapling[1]

Primary Objective: Hemostasis and leak prevention with optimal compression applied

Causes of potential leaks/hemorrhage from surgical stapling:

- Mechanical/tissue
  - Secondary to staple line failure
  - Most common cause of leaks
  - Usually within 2 days post-op
- Ischemic
  - Usually 5-7 days post-op
  - Rare

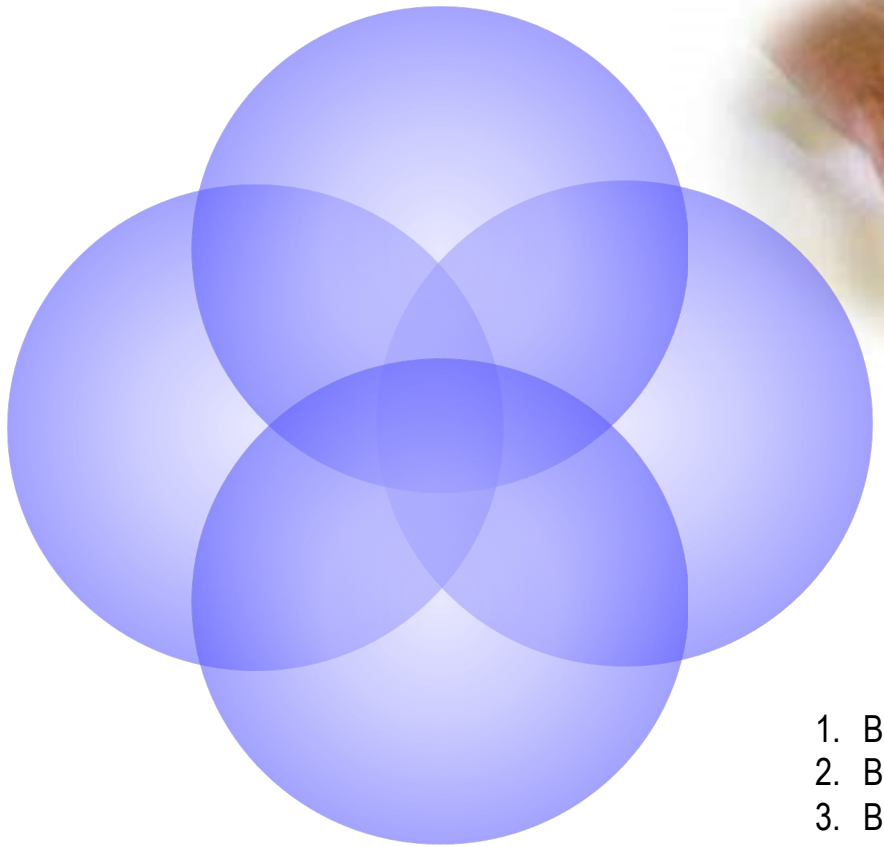
1. Baker RS, et al. *Obes Surg.* 2004;14:1290-1298.

Tissue Characteristics[1-4]

Hysteresis

Think of memory foam…

Biphasic nature



Viscoelasticity

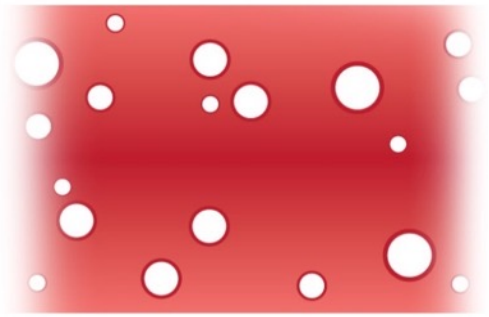
Tissue creep

1. Baker RS, et al. *Obes Surg*. 2004;14:1290-1298.
2. Bischoff JE. *Ann Biomed Eng*. 2006;34(7):1164-1172.
3. Bischoff JE, et al. *Biomech Model Mechanobiol.* 2004;3(1):56-65.
4. Gu WY, Yao H. *Ann Biomed Eng*. 2003;31(10):1162-1170

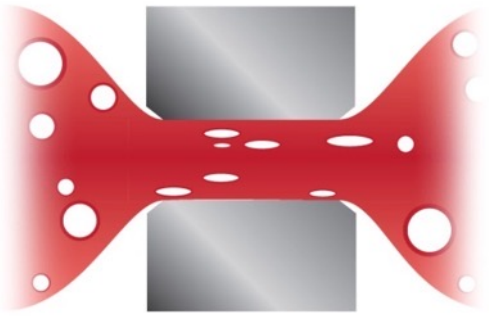
Properties of Tissue

- Living tissue mainly consists of solid and fluid (biphasic nature)
- Tissue thickness changes when external force is applied, then tissue also has properties to return to the original shape over time (viscoelastic nature)
- Based on biphasic and viscoelastic nature, we have to consider… when using staplers
  - Thickness
  - Compressibility
  - Property variability

Tissue Dynamics in Action: Stapling Tissue



Living tissue before compression
.



Living tissue compressed to adequate thickness for stapling.

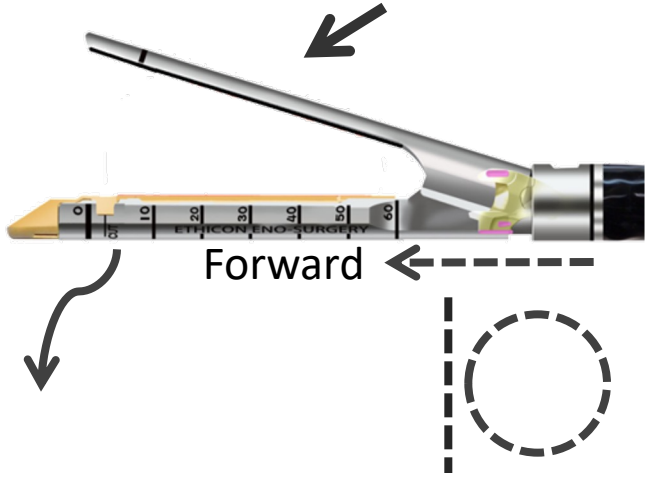
Energy is stored in the staple as compression is maintained

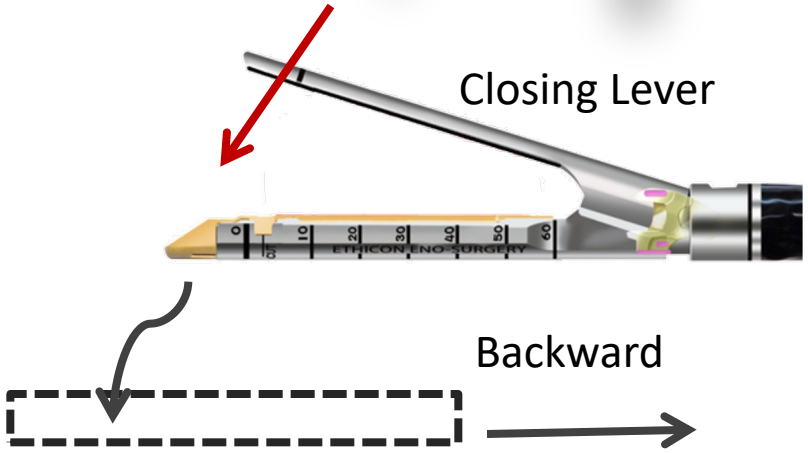
Two types of compression

Focal Compression (V-shape)

25% Stronger

Cam Tube Compression (Parallel)



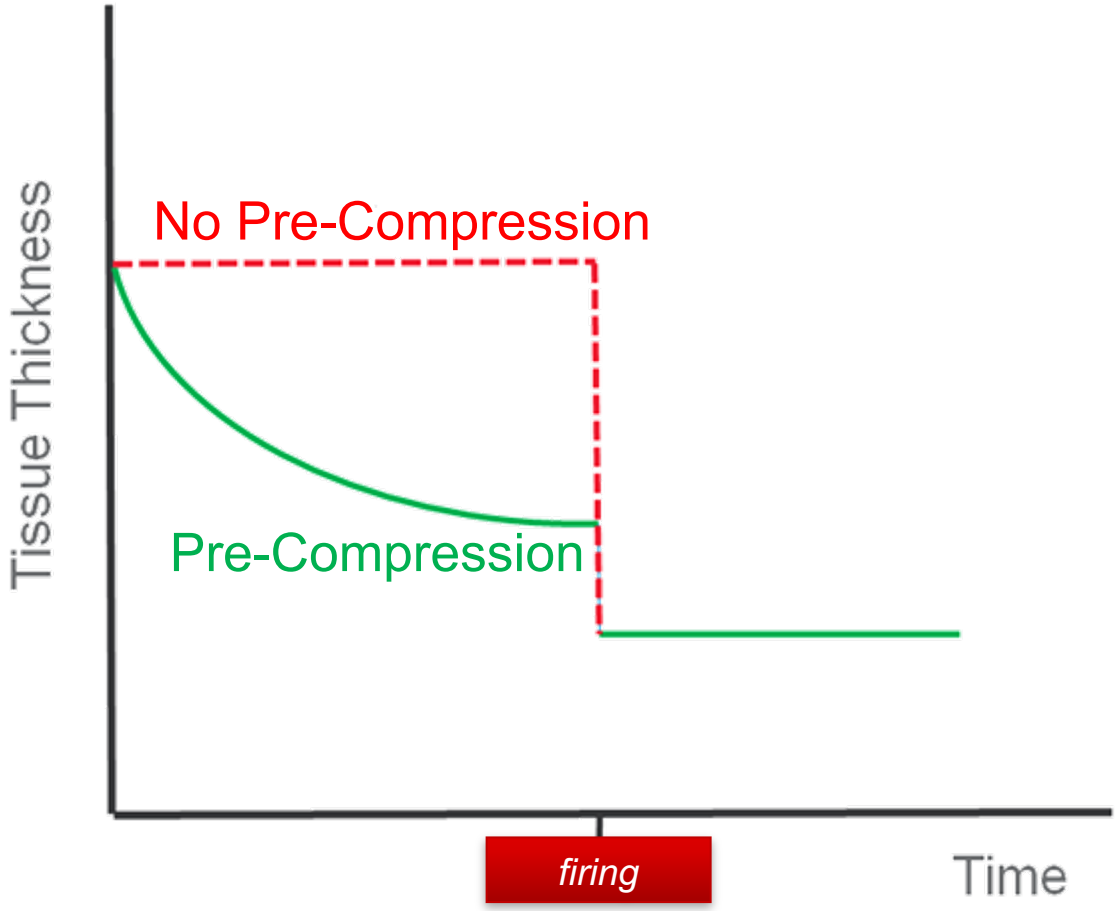



3
4
5


ETHICON ENDO-SURGERY

Pre-Compression

Pre-compression is necessary for a good staple formation



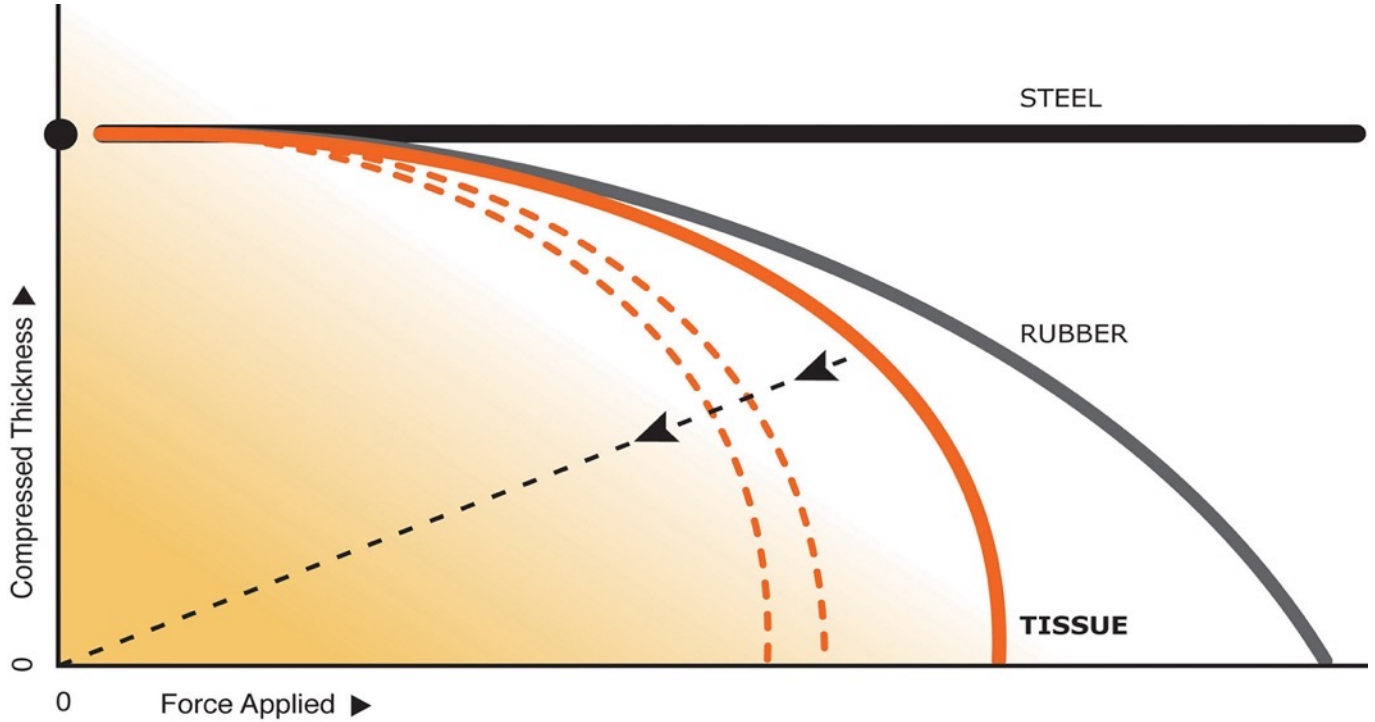
Graph for illustrative purposes only where tissue thickness is greater than the closed staple height

Holding compression before firing:

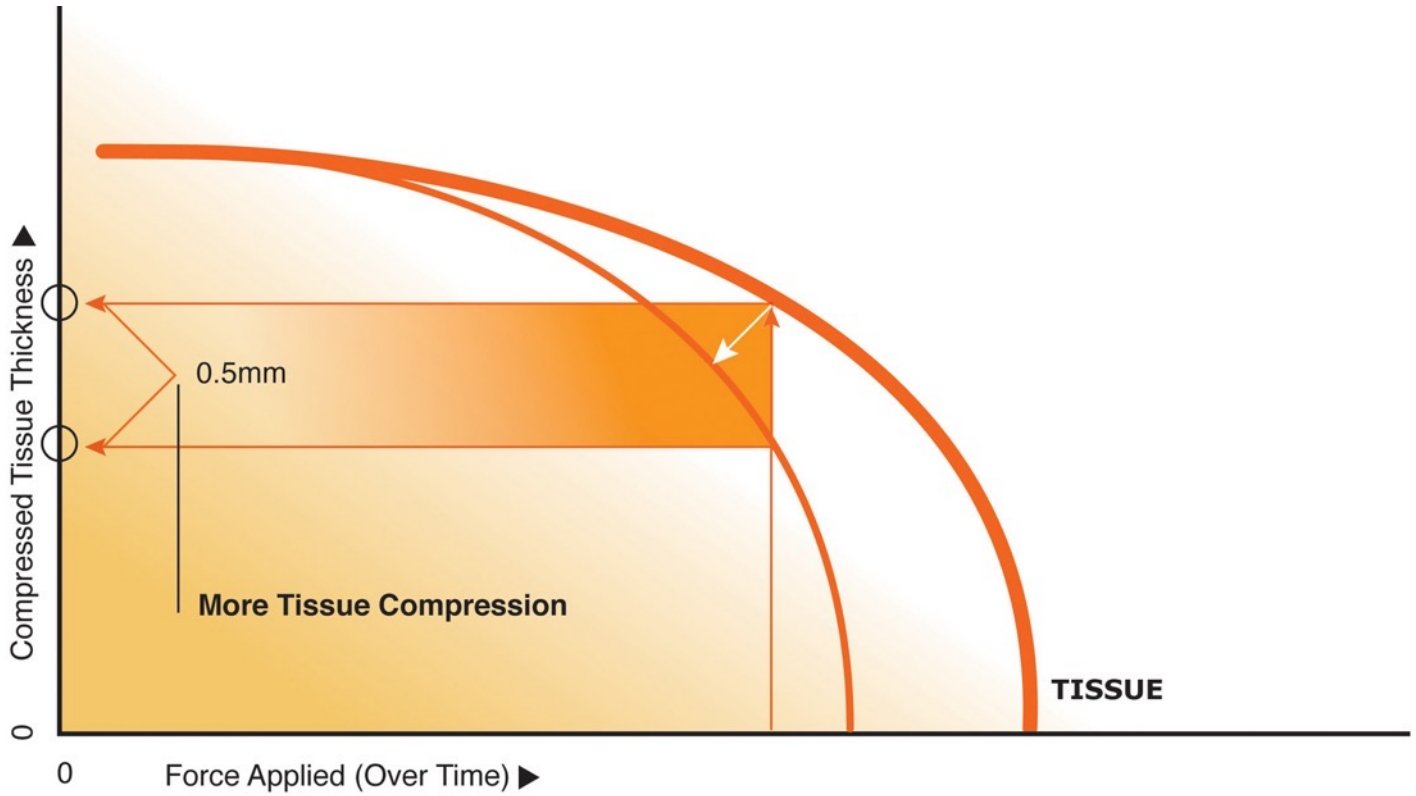
- Prepares the tissue to be fired upon
- Reduces stress on the tissue prior to firing
- Minimizes tissue flow
- Optimizes staple formation

Compression Dynamics

Reaction of Different Materials Under Pressure: Tissue

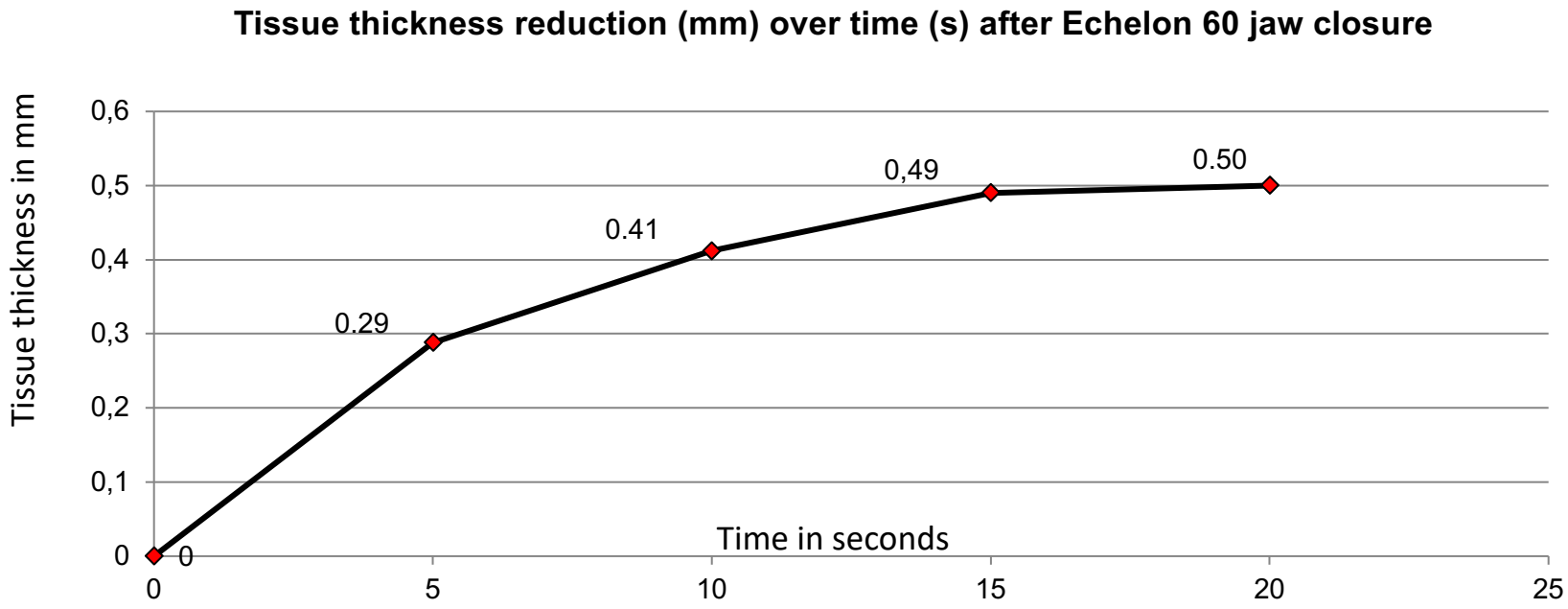


Compression Dynamics



15 seconds gives an optimal thickness

Sample: Echelon 60mm



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Program Studi Ilmu Bedah

RSCM

ETHICON
PART OF THE Johnson & Johnson FAMILY OF COMPANIES

Tissue thickness varies widely throughout the body from organ to organ.

Even within each organ, tissue thickness ranges greatly.[1]

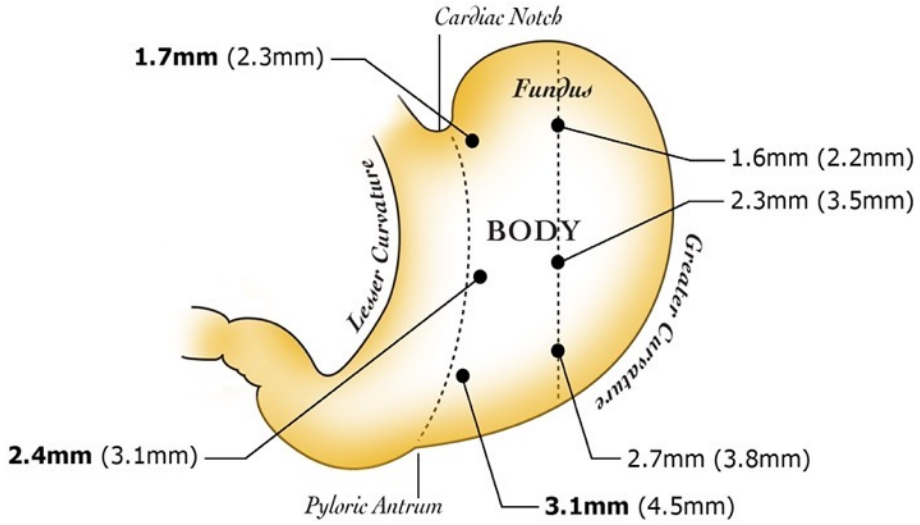


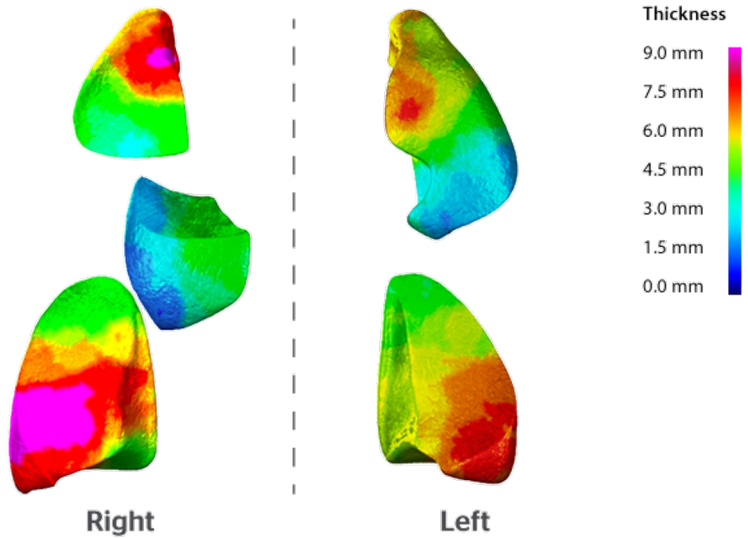
Diagram of the stomach indicating the locations of measurements* (n=50) measurements at each location

*Mean measurement (maximum measurement)

1. This illustration is intended solely as a quick reference guide for tissue thickness measured on e xcised gastric specimens of obese patients. For interpretation of the information above, please refe r to the complete article: Elariny H, Gonzalez H, Wang B, Tissue thickness of human stomach mea sured on excised gastric specimens of obese patients. *Surg Technol Int.* XIV (2005); 14:119-124.

Tissue thickness varies organ by organ

Tissue thickness in a given organ varies location by location [1]



1. This illustration is intended solely as a quick reference guide for tissue thickness measured on excised human lung specimens. The thickness map has been derived by interpolating values between singular points of measurement and is for illustrative purposes only (n=12). As measured in A-P direction at 8g/mm^2 at 15 seconds, thickness may vary with different (surgical) approaches.

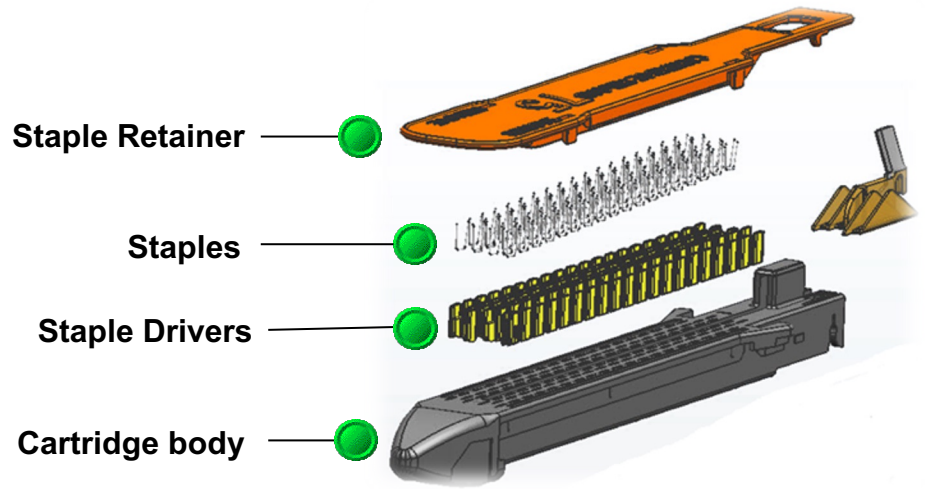
The Staple & Cartridge Configuration

Appropriate staple formation is a combination of the instrument and cartridge interaction with living tissue.

B-Form Staple

3D Staple

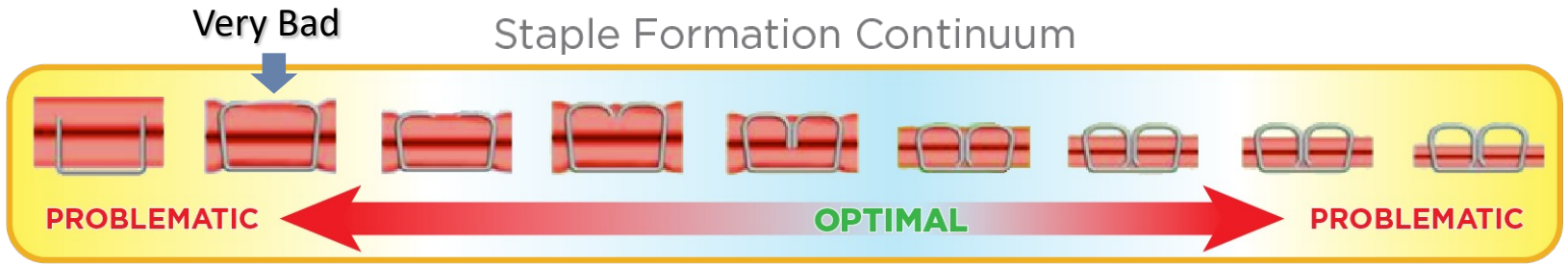
EES Linear Cutter Cartridge
with 3D Staples



The Function of Surgical Stapling

- Primary Objective: Hemostasis and leak prevention

- Cause of Leak and Hemorrhage
  - Wrong staple height selection (cartridge or reload)

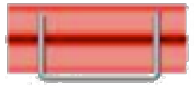


Baker RS, et al. *Obes Surg*. 2004;14:1290-1298.

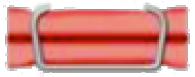
The Staple Formation Continuum

Proper staple formation is necessary to achieve a leak-proof and hemostatic staple line. A staple is considered malformed when the legs of the staple do not close properly after deployment. When staples are malformed or not secure, surgical outcomes may be compromised.

Staple migration during firing



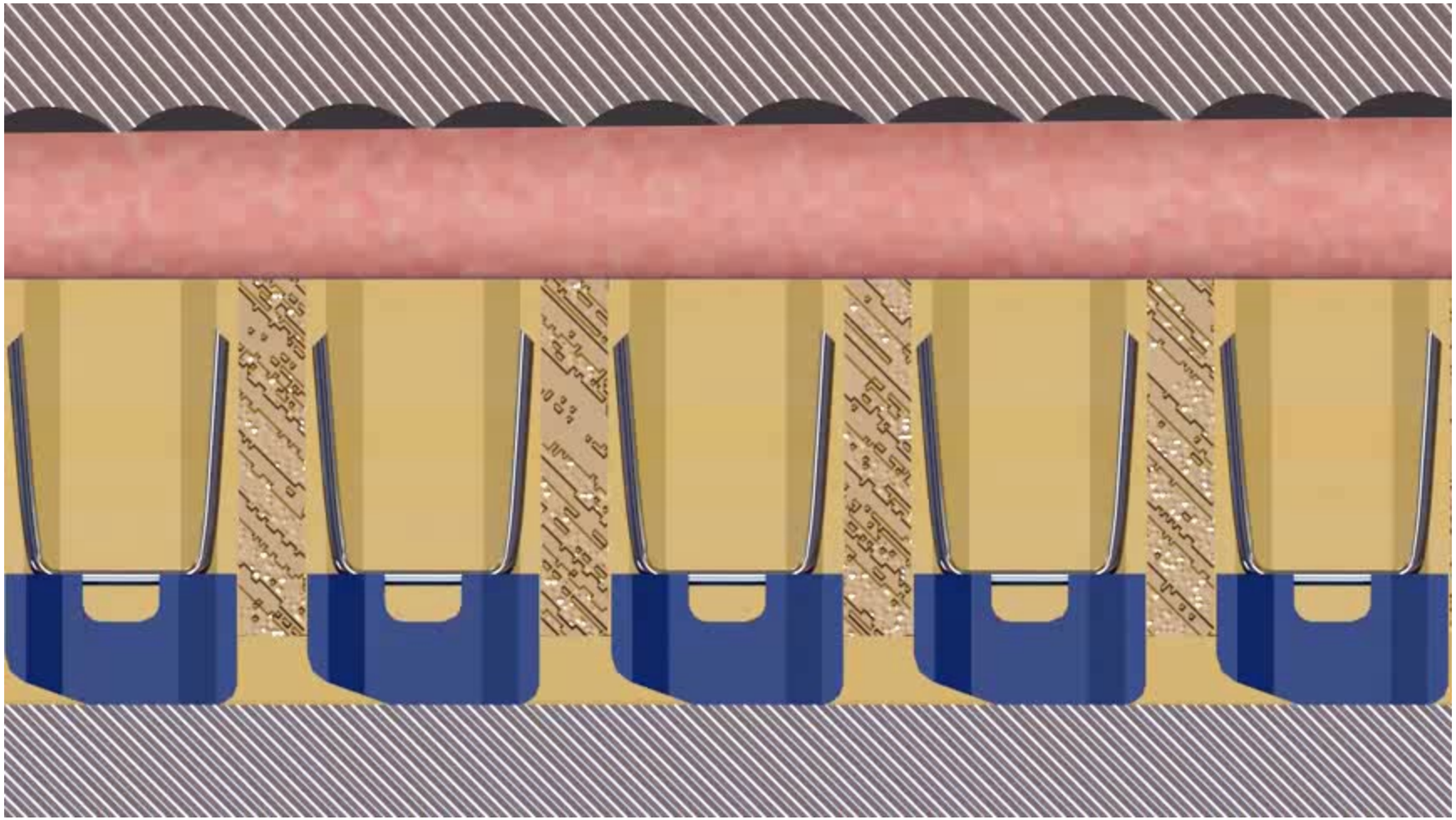
BAD

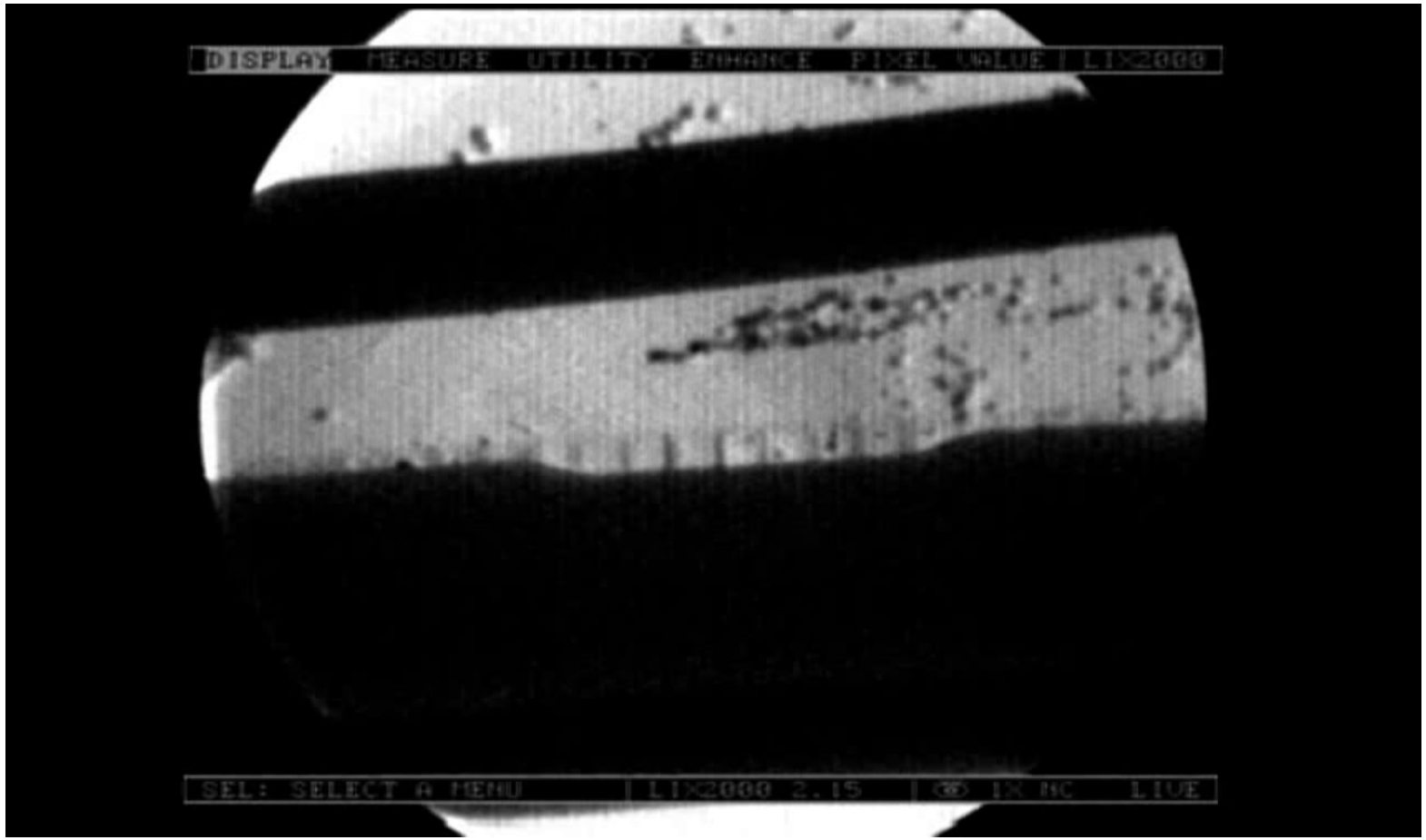


VERY BAD
Staple legs lie on top of tissue.

GOOD
The tissues have been pierced three times. The legs are bent over and pierce the tissue. This staple line will hold.

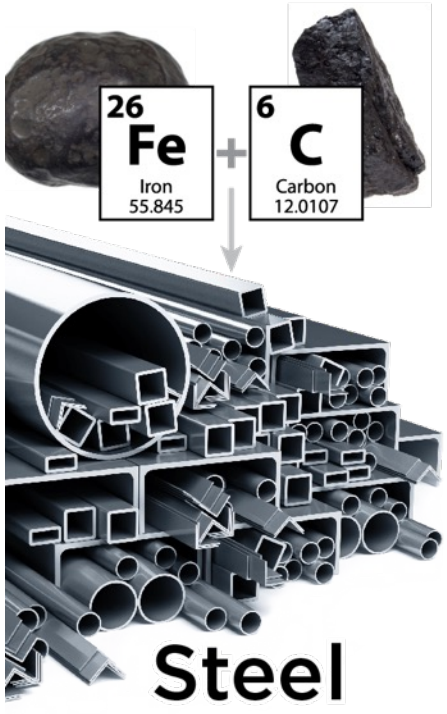
GOOD
Tissue will tear before staple comes open.




DISPLAY MEASURE UTILITY ENHANCE PIXEL VALUE LIX2000
SEL: SELECT A MENU
LIX2000 2.15
IX NC
LIVE

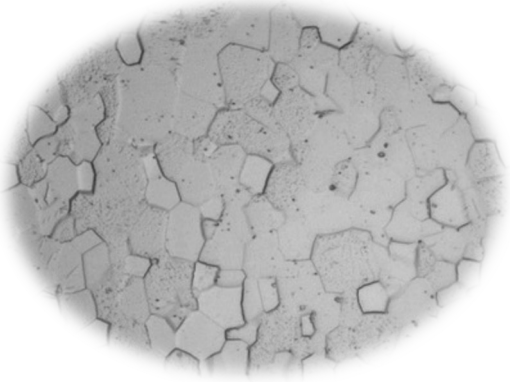
Structure of Unalloyed Titanium Compared to Titanium Alloy

Just as steel achieves it's high-strength from combining iron and carbon…



Commercially Pure Titanium

Consists of a single phase th at is relatively soft in the ann ealed state



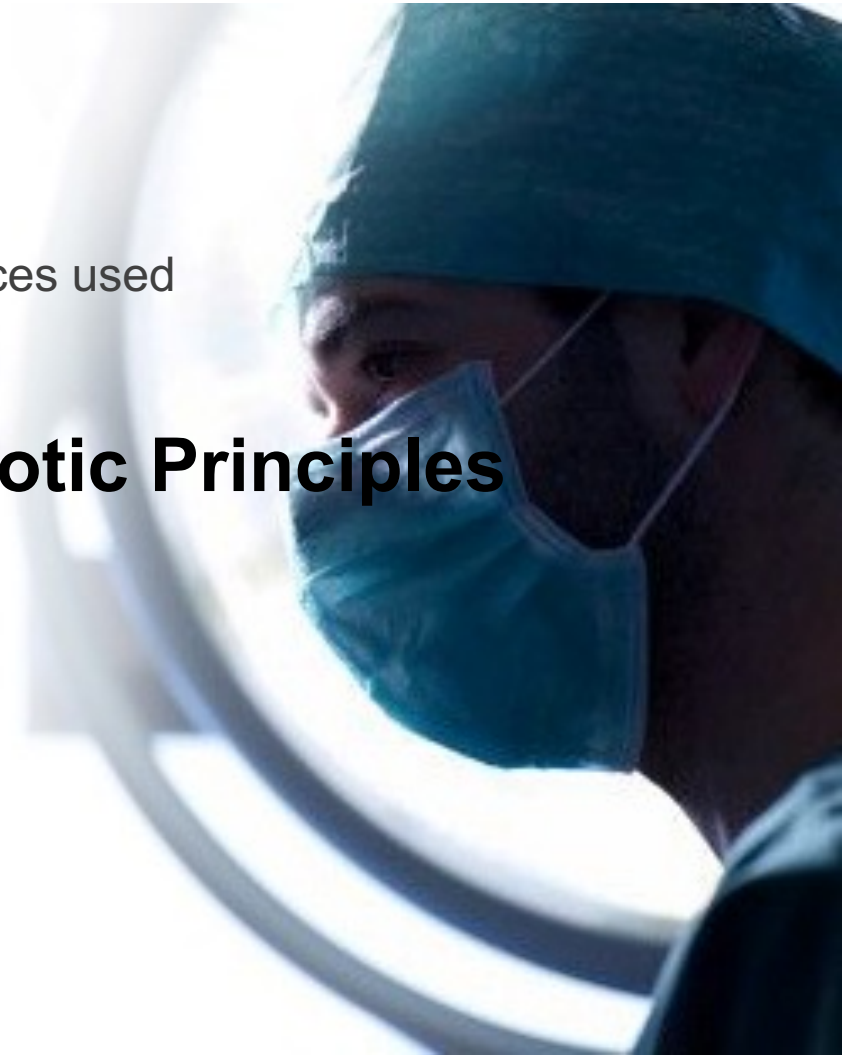
Titanium Alloy*

Consists of two different phase s that results in a higher streng th in the annealed state

* Ethicon uses Ti 3 Al 2.5 V and Ti 6 Al 4 V for staples

Human Factors

- **Preoperative**
  - Surgeon Training , comfort with devices used
  - Patient Co-morbid Conditions
  - Prior Treatment and Surgical Prep
- **Intraoperative - Anastomotic Principles**
  - No Tissue Tension
  - Leak-Proof Anastomosis
  - Good Hemostasis
  - Adequate Blood Supply
  - Adequate Lumen
- **Postoperative**
  - Pain Control – NSAIDs, Narcotics
  - Inflammatory Response & Healing



End of modules: Thank You