

## TENSION-RELIEVING TECHNIQUES



Bryden J. Stanley, BVMS, MANZCVS, MVEtSc, MRCVS, Diplomate ACVS

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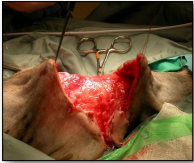
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## Many options for closing defects...

- Compared to humans and horses, small animals have lax skin attachment
  - Exceptions —
  - Extensively manipulated
- We can "persuade" skin to go places it hasn't been before!



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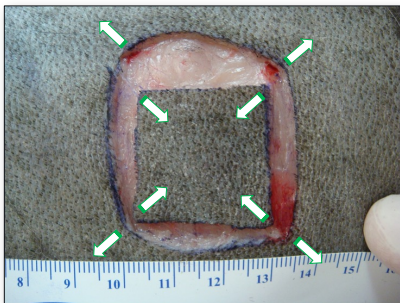
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## Skin is viscoelastic...



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**Tension-relieving techniques ...**  
 allow local tissues to be mobilized to cover a defect without raising a flap or harvesting a graft.

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BEFORE RECONSTRUCTION...

Wound:

1. Free of infection
2. Good blood supply
3. Healthy periwound condition



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The greatest enemies of wound closure are  
**Tension and Motion and Pressure**



Aim to minimize these forces.

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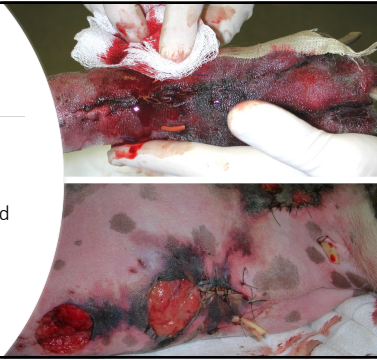
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No wound should be closed by simple approximation if the resulting tension will lead to ischemia and subsequent necrosis.



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Tension-relieving Techniques:

- Listen to the skin
- Undermining
- Strong subcutaneous suturing
- Stent & bolster sutures
- Pretensioning
- Incisional NPWT
- FNNF and FFNN sutures
- Mesh expansion
- Simple relaxing incision
- Walking sutures
- Z-plasty
- V-Y plasty
- M-plasty



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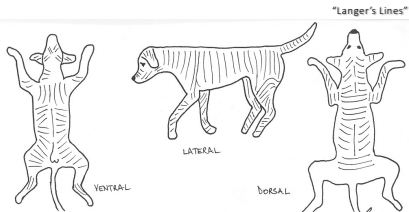
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Listen to the skin

- Tension lines in the skin = predominant pull of the fibrous tissue within the skin.
- Should be considered when:
  - Making an incision
  - Closing a defect



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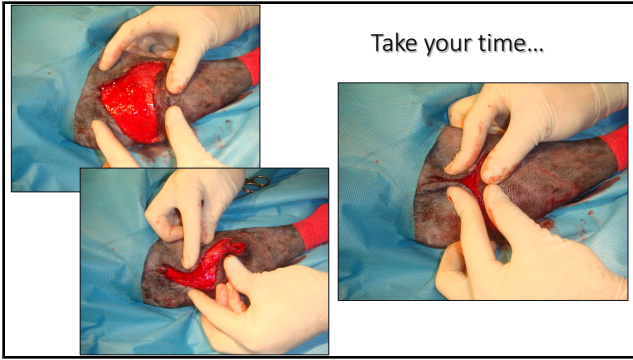
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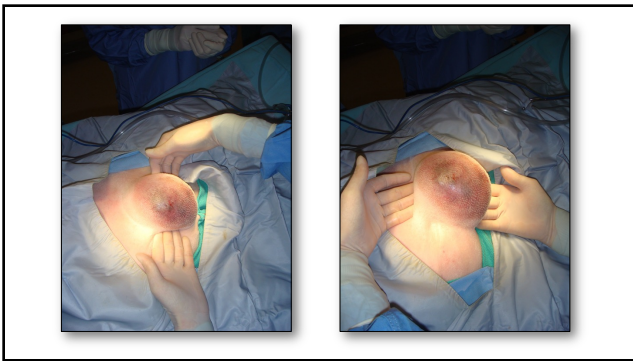
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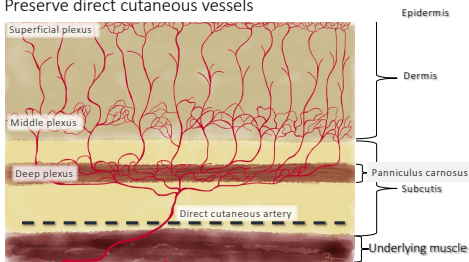
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- Undermine deep to panniculus muscle
- Use sharp and blunt dissection
- Preserve direct cutaneous vessels



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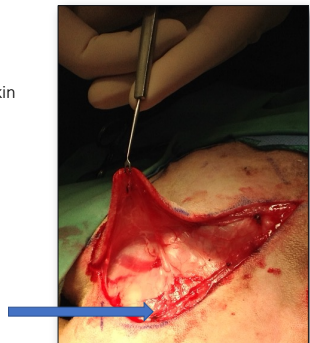
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### Undermining

- Allows full elastic potential of skin
- Only do as much as you need
- Periwound must be in good condition



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Strong subcutaneous suture line

A strong subcutaneous suture line will reduce tension on skin suture line.



Only subcutaneous layer has been placed... skin sutures are still to come.

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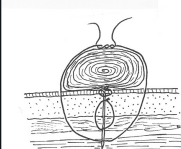
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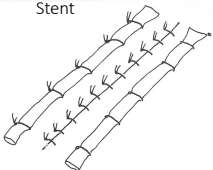
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**Bolster**



**Stent**



- Pre-place deep in wound
- Good distance from wound edge
- Heavy gauge suture
- Good padding
- Remove at 3 days

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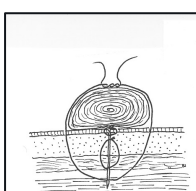

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**Bolster**

The greatest enemies of wound closure are motion and tension.  
There is a lot of shear force on this incision, due to motion of the forelimbs.

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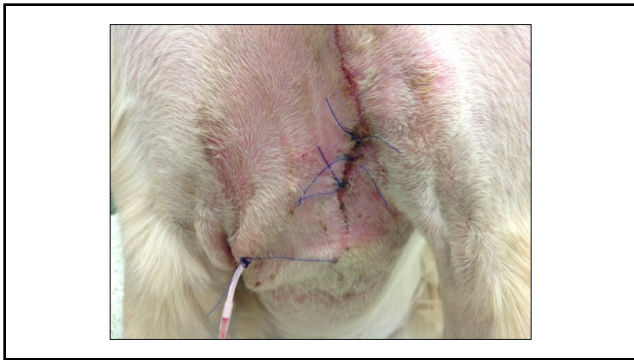
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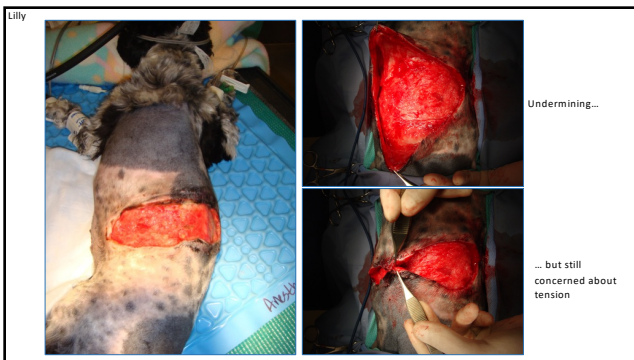
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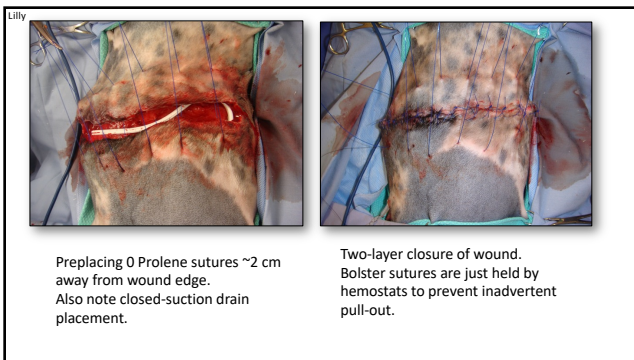
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Preplacing 0 Prolene sutures ~2 cm away from wound edge. Also note closed-suction drain placement.

Two-layer closure of wound. Bolster sutures are just held by hemostats to prevent inadvertent pull-out.

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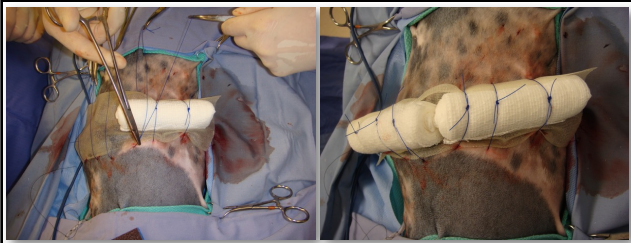
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Non-adherent dressing over suture line (Adaptic, Telfa)  
Soft padded bolster over the suture line.  
Bolster sutures are tightened to just take up tension.

Lilly

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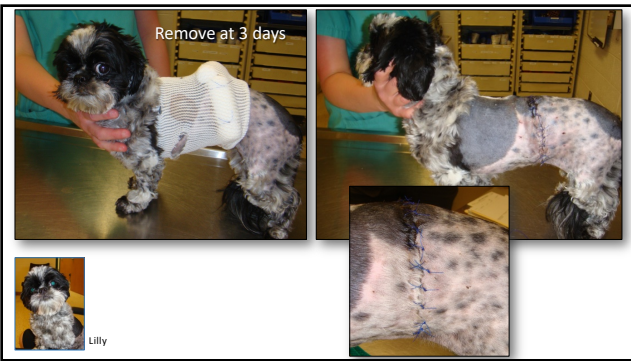
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Remove at 3 days

Lilly

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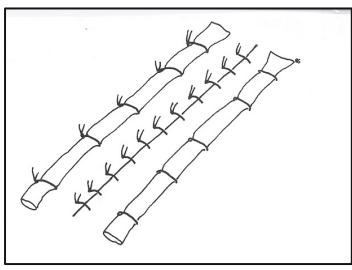
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Stent Sutures: over mobile areas



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Oscar

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Nina

Significant shear stresses on wound closure, due to motion.

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Nina

Don't forget to play with the wound to assess best closure!

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Nina

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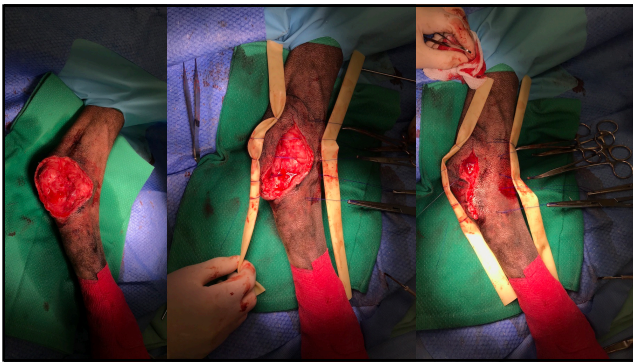
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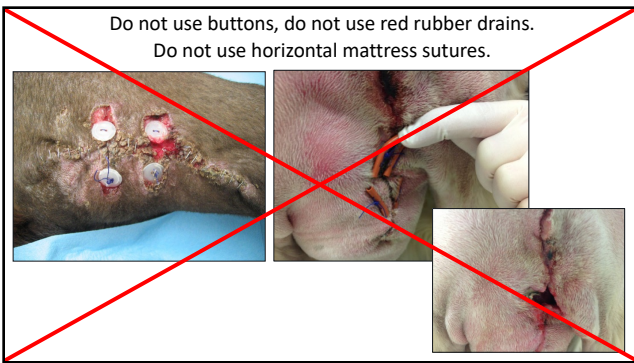
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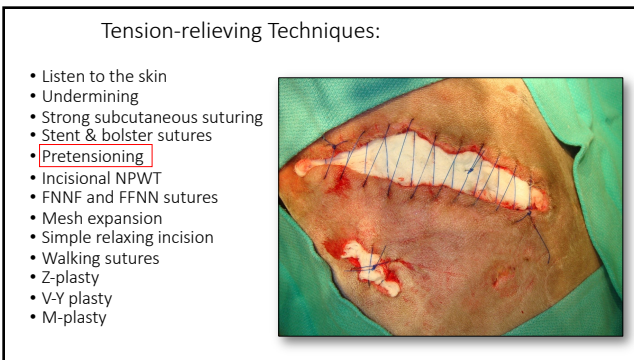
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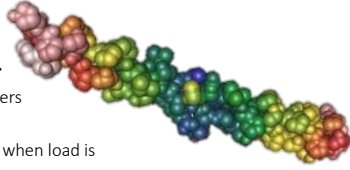
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### Pretensioning

- Constant, short-term loading →
- Stretching of coiled collagen fibers
- Fracturing of elastin fibers
- → skin loses tendency to recoil when load is removed = STRESS RELAXATION
- → skin appears to elongate = MECHANICAL CREEP
- Repeat loading every 12-24 hours, up to 72 hours



(Biological creep: creation of new components under prolonged constant loading)

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### Pretensioning techniques – many

- Continuous suture line
- Continuous horizontal intradermal
- External skin stretchers with velcro
- Lembert presuturing before resection



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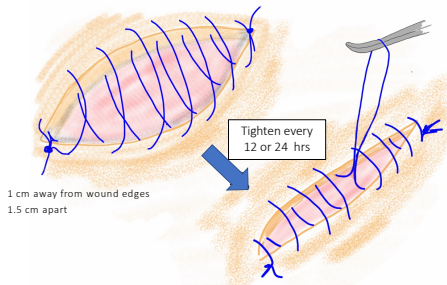
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### Pretensioning – simple continuous



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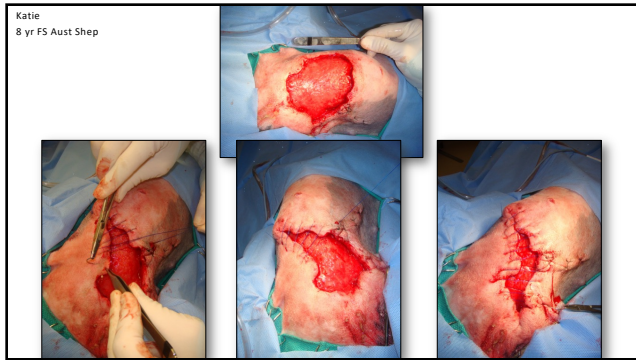
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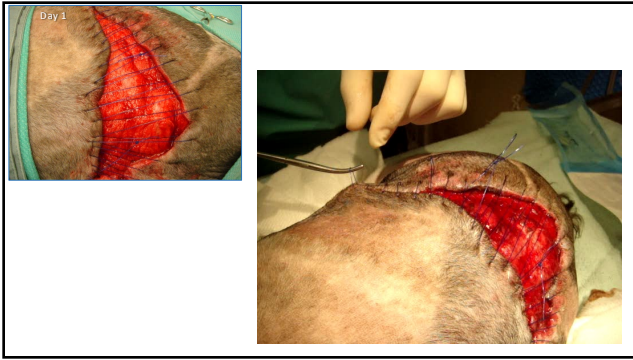
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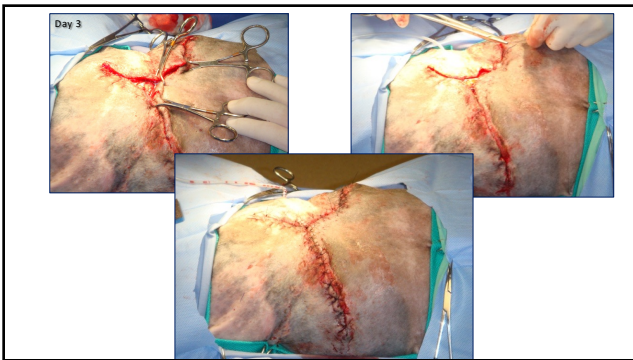
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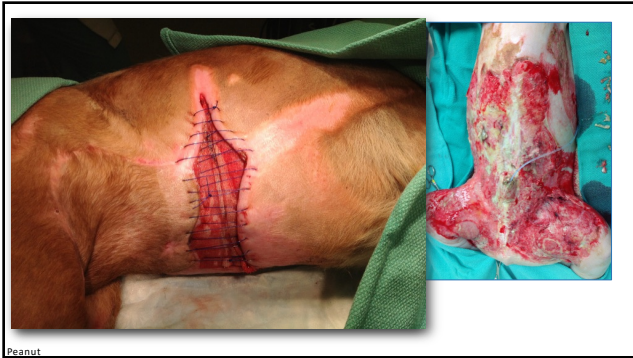
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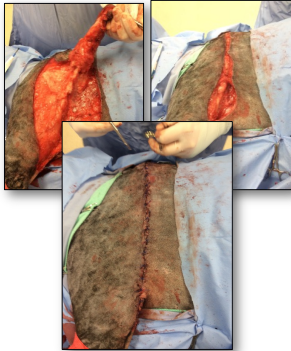
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## POST-SUTURING

- If you think there is too much tension on closure **after** you have closed wound
- Ideal for mobile areas
- Protection
- Peace of mind



Boone

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Boone

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3 days later: remove the Velcro tabs



Boone

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Tension-relieving Techniques:

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15 slides are redacted because the data are still unpublished. They will, however, be shown in the talk.

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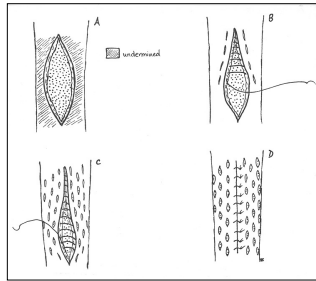
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### Mesh Expansion

- Extremities typically
- Can also be employed on proximal limb & trunk
- Undermine first
- Multiple, stab incisions parallel to wound edges
- 1cm incisions
- 1 cm apart
- 1 cm between rows, staggered

Enables skin to be gently expanded without excessive tension



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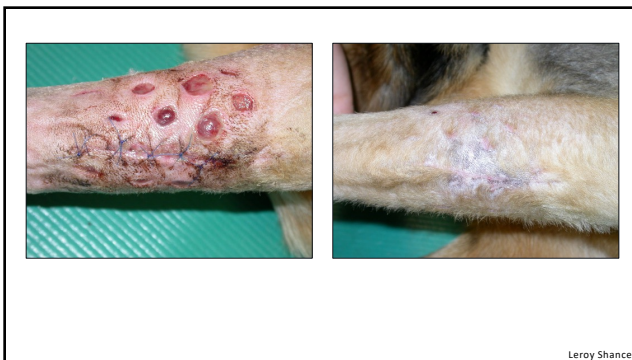
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Marshall

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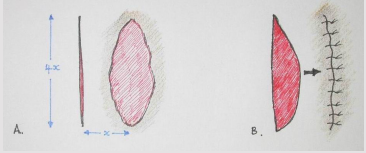
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Simple relaxing incision

- = bipedicle advancement flap
- Relaxing incision adjacent to defect
- Do not make skin flap too narrow!
- Undermine
- Close defect
- New defect – 2<sup>nd</sup> intention or primary
- Can be used bilaterally



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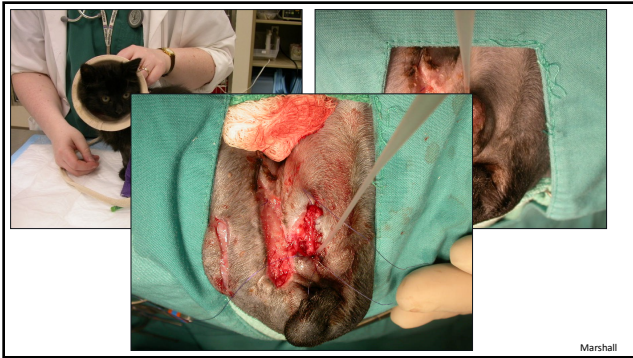
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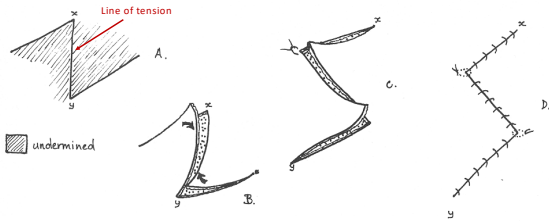
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Z-Plasty: • Relieves tension along the axis  
• Creates two triangular flaps



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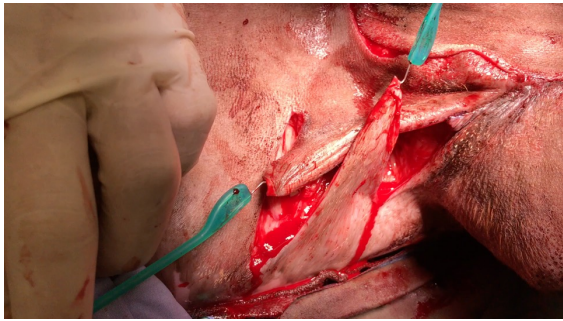
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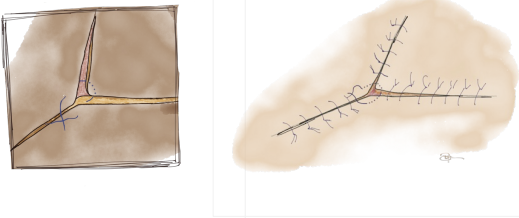
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Half-buried mattress suture



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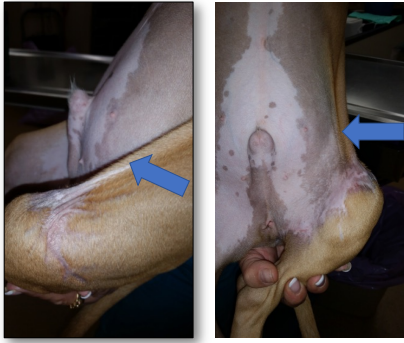
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Z-Plasty:



Ali Rescue

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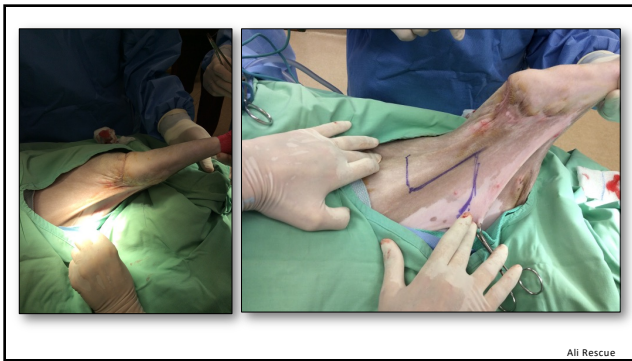
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Ali Rescue

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**Key Points**

- Dogs and cat skin can be "persuaded".
- Undermine appropriately.
- Spread tension away from the primary suture line.
- Viscoelastic skin enables stress relaxation & mechanical creep.
- Use pretensioning with other techniques.
- Remember relaxing incisions.

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