The Cornea: 0.5mm is all you get

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Ulcerative Keratitis
- Most ulcers are simple and heal in 24-72 hours, often DESPITE what the Veterinarian does.
- When they fail to do so:
  - Did I miss the etiology?
  - Is it infected?
  - Have I done a culture/cytology?
  - What drugs are being used?
  - Is it time to discuss surgery?

Anatomy/Physiology - Cornea
- 4 Layers of the Cornea
  - Epithelium
  - Stroma
  - Descemet's membrane
  - Endothelium

Cornea Epithelium
- 8-10 cell layers thick
- 7 day turnover

Diagnostic tests for corneal abnormalities
- Examination
- Finoff
- Biomicroscopy
- Culture
- Schirmer tear test
- Fluorescein dye
- Cytology
Diagnostic tests for corneal abnormalities

- Examination
- Finoff

Biomicroscopy

Getting Old?

You have many choices in loupes

Loupes

Bad Choice

You get what you pay for

Recommend:
- Zeiss - $$$
- Keeler
- Heine

Good Choice

Diagnostic tests for corneal abnormalities

- Examination
- Finoff
- Biomicroscopy
- Culture
Diagnostic tests for corneal abnormalities

- Examination
- Finoff
- Biomicroscopy
- Culture
- Cytology

Cytology

www.microbrush.com

Diagnostic tests for corneal abnormalities

- Examination
- Finoff
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- Schirmer tear test

Fluorescein dye
Diagnostic tests for corneal abnormalities

- Examination
- Finoff
- Biomicroscopy
- Culture
- Schirmer tear test
- Fluorescein dye
- Cytology
- Biopsy and histopathology

Ulcerative Keratitis

- Ascertain the etiology of the lesion.
- Examine the eye for:
  - eyelid abnormality

Tear Break-up

Abnormal Tear Break-up - Canine

Ulcerative Keratitis

- Ascertain the etiology of the lesion.
- Examine the eye for:
  - eyelid abnormality

Entropion

Trichiasis
Ulcerative Keratitis

- Ascertain the etiology of the lesion.
- Examine the eye for:
  - eyelid abnormality
  - adherent hair
  - foreign body
Ulcerative Keratitis
- Ascertain the etiology of the lesion.
- Examine the eye for:
  - eyelid abnormality
  - adherent hair
  - foreign body
  - tear deficiency
  - STT
  - TBUT

Ulcerative Keratitis
- Complete history
- duration
- previous therapy (especially corticosteroids)

Superficial Corneal Ulcer
- Generally extremely painful
- Heal within 72 hours when the cause has been removed
Superficial Corneal Ulcer
- Generally extremely painful
- Heal within 72 hours when the cause has been removed
- If the ulcer has not resolved in 3 to 5 days:
  - cause is still present
  - ulcer is infected
  - indolent ulcer is present

Indolent Ulcer
- Boxer ulcer, Recurrent erosion

Indolent Ulcer
- Hallmark features:
  - Superficial
  - Nonpainful to mildly painful
  - Loose or redundant epithelial borders
  - Usually middle aged to older dogs
  - Chronic in nature
  - Predisposed breeds - boxers
Indolent Ulcer

Debride

Grid Keratotomy

Debride

Grid Keratotomy
Algerbrush diamond burr

3.5mm, medium grit tip

Diamond Burr Debridement

Outcome
- Debridement - 63% healed after single procedure
- 28% healed at 1st postop visit
- GK - 85% healed after single procedure
- 78% healed at 1st postop visit
- SK - 100% healed after single procedure
- 88% healed at 1st postop visit

Indolent Ulcer
- Treatment:
  - Client education is essential
  - Remove loose, redundant epithelium
  - Gently break the basement membrane with 25g needle (Grid keratotomy)
  - Diamond burr
  - Topical tetracycline - 50% reduced time to heal (oral doxy also works)
  - Recheck every 7-14 days

Tetracycline and Refractory Ulcers In Vivo

Chandler H, Colitz CMH 2005
Indolent Ulcer

- Treatment:
  - Contact lens:
    - 15mm diameter, thin, soft bandage lens
    - >8mm base curve
  - Acrivet
  - Antibiotics

Placing the Acrivet Contact Lens

Housed in:
Acrivet, Inc.
9067 South 1300 West
Salt Lake City, UT 84088
USA

Indolent ulcer – 3 month duration

Not treated correctly now heals by granulation
Adult cat - herpes
- classic dendritic ulcer
- no URT signs

Herpes
- Diagnosis
  - dendritic or punctate superficial corneal ulcers
  - pathognomonic for herpes keratitis

Herpes felis
- 70% of cats infected with herpes virus will become carriers
- recurrent conjunctivitis/keratitis
- stress and immunosuppression will predispose to recurrence
  - FeLV
  - FIV
  - Other

Herpes felis
- Diagnosis:
  - History - previous stress?

Treatment:
- Antiviral agents topically
  - Idoxuridine - Stoxil, Herplex
  - Trifluorothymidine - Viroptic
  - q2-4 hr
  - Cidofovir 0.5%
  - Q12 hr
Herpes felis

- Treatment
  - Antivirals - Systemic
    - Famciclovir
      - Variable doses listed
      - 65 mg/cat divided daily
      - New data suggests 40 mg/kg PO
      - 90 mg/kg PO TID
  
Herpes felis

- Treatment:
  - L-lysine, 250-500 mg/day PO

Herpes felis

- Interferon
  - 30 units PO 7 days on/7 days off and repeat
  - 3,000 - 6,000 units/ml topically

Herpes felis

- Intranasal vaccine

Midstromal Corneal Ulcer

- Managed medically
- Associated anterior uveitis
- Cytology
- Culture/Sensitivity
Midstromal Corneal Ulcer
- Treatment:
  - Topical antibiotics
    - Broad spectrum, every 2-6 hours
    - Neomycin-bacitracin-polymyxin
    - Gentamicin - poor choice
    - Ciprofloxacin
    - Levofloxacin
    - Gatifloxacin

Midstromal Corneal Ulcer
- Treatment:
  - 1% Atropine
    - as needed to dilate the pupil, but not more than 4x/day

NO Corticosteroids Topically!!!!

Deep/Desmetocele Corneal Ulcer
- Fluorescein negative centrally

Midstromal Corneal Ulcer
- Surgery if progressive
- Desmetocele
- Melting/collagenase ulcer
- Acute eruptive keratopathy
- feline
Melting Corneal Ulcer
- Enzymatic breakdown of the cornea

Surgery often indicated
- Debridement of the melting portion

Treatment:
- As for deep ulcers, but more aggressive
- Antibiotics are administered every 1-2 hours
  - Ciprofloxacin
  - Levofloxacin
  - Gatifloxacin
- Anticollagenase
  - Serum
- Tetracycline - topical, systemic
- +/- Surgery

Acute Eruptive Keratopathy
Possible association with systemic immunosuppression

Acute Bullous Keratopathy
- Retrospective MSU/OHio State
- 14 cats from 2000-2008
- 12/14 with systemic disease
- 10/14 on systemic immunosuppressive therapy
  - 8/10 -prednisolone (1-2 mg/kg q 12-24h)
  - 8/10 on concurrent cyclosporine (1.5-7 mg/kg q 12-24h)
- 19/28 eyes developed ABK
- 13/19 eyes remain sighted

Pierce KG, Sitaloon J, Vasbien CA et al: AN ASSOCIATION BETWEEN ACUTE BULLOUS KERATOPATHY AND ADMINISTRATION OF SYSTEMIC ANTI-INFLAMMATORY/IMMUNOSUPPRESSIVE THERAPY IN CATS. ACVO 2010
Acute Eruptive Bullous Keratopathy

Descemet's membrane rupture

Treatment with conjunctival graft or 3rd eyelid flap

Acute Eruptive Bullous Keratopathy

Corneal Surgery
- General anesthesia
- Non-depolarizing neuromuscular blocking
- Head positioning is essential

Microsurgery
- Patient position critical
- No movement under anesthesia
- Sand bags
- Vacuum pillows
- Paralysis

Fundamentals of Microsurgery
- Prior to surgery
  - Position the patient
  - Lateral vs dorsal recumbency
  - Sand bags, vacuum pillows
  - Eye looks up into microscope
Pre-Operative Prep

- Clip hair
- 0.5% povidone iodine (1:20 to 1:50 dilution)
- Final prep - povidone iodine 10%
- Avoid chlorhexidine

Corneal Surgery

- Exposure
- Do you need a lateral canthotomy?
Superficial Keratectomy

- Thickness of the normal canine cornea is 0.4-0.7mm
- #64 Beaver blade/Desmarres corneal dissector

Avoid tension in this direction

Feline Sequestrum Keratectomy

http://youtu.be/vB0P3lJmvXU

https://www.youtube.com/watch?v=JjHo6-TR3s0
Superficial Keratectomy

Sequestrum

May spontaneously slough

Conjunctival autografts

- Advancement, hood, bridge, pedicle, and complete conjunctival graft
- Bulbar vs palpebral conjunctiva
- Indications:
  - deep non-perforating corneal ulcers that have failed to respond to medical therapy
  - descemetoceles
  - mycotic keratitis
  - bullous keratopathy
  - recurrent erosions
  - stromal abscessation
  - keratomalacia

Conjunctival Pedicle Graft

Dissect dorso-lateral conjunctiva
Conjunctival Pedicle Graft

Keratectomy prepares site

Epithelial to epithelial apposition

http://youtu.be/qC2Amv5RW-k

http://youtu.be/IRzC3lHRdps

http://youtu.be/TrwtttbootUjY

http://youtu.be/IRzC3lHRdps
Graft Failure

Ischemic necrosis will usually re-vascularize and succeed
Corneal Perforation

Iris prolapse

Corneal-Conjunctival Graft

1 yr post-op

Corneal-Conjunctival Graft

http://youtu.be/NvwnZhGpK6M

Corneal-Conjunctival Graft

http://youtu.be/JHx6-TR8J0

Feline corneo-conjunctival graft

24 hr post-op

Feline corneo-conjunctival graft

1 yr post-op
Canine corneo-conjunctival graft

Canine Limbal Melanocytoma

Use of commercial collagen to repair:
- Acell®
- BioSISt®

Limbal melanoma – excision plus
- diode laser
- BioSISt®
Corneal endothelial dystrophy

Treatment:
- hyperosmotics
- conj graft
- fresh transplant
Endothelial Dystrophy Keratoleptynsis

http://youtu.be/qX4hSpXn5pw

Pigmentary Keratitis
- Common in
  - Pug, KCS
  - chronic keratitis
- Treatment
  - Keratectomy
  - Cryosurgery?

Adjunctive cryotherapy for pigmentary keratitis in dogs: a study of 16 corneas
Thiya A. Andrey

Corneal Trauma
- Perforation / Laceration
- Sharp Corneal Trauma
- Blunt Corneal Trauma
Corneal Trauma

- Sharp Trauma
- Blunt Trauma

Cat Claw
- Non Perforating
- Perforating
- Perforating with Iris prolapse

Seidel Test
Seidel Test

Positive Seidel Test - Canine

Magnification
Epinephrine
Viscoelastic
8-0 to 9-0 suture
Microsurgical instruments

http://youtu.be/ex8EZVpP2aI
Pre-op

1 yr post-op

Cat Claw
Perforating with
Lens capsule tear

Cat Claw
Perforating with
Iris prolapse

Phacoanaphylaxis

Blunt vs Sharp

Blunt trauma

So what do you think?
Prognosis?
Vitreous echo-hemorrhage
Posterior scleral rupture
Normal