

## PLATELET RICH PLASMA: A NEW TREATMENT OPTION FOR TENDONOSIS?

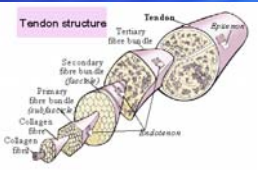
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## OVERVIEW

- TENDONITIS VS TENDONOSIS
- COMMON PROBLEM AREAS
- CLINICAL PRESENTATION
- DIAGNOSTIC STRATEGIES
- TRADITIONAL TREATMENT
- PLATELET RICH PLASMA

### TENDONITIS/TENDONOSIS

- TENDON—COMPOSED OF 78% H<sub>2</sub>O, 20% COLLAGEN, 2% GAG
  - HISTOLOGIC ARRANGEMENT REFLECTS FUNCTIONAL REQUIREMENTS



### TENDONITIS/TENDONOSIS

- FACTORS INFLUENCING TENDONS
  - AGE AND SEX
  - SKELETAL MATURITY
  - BODY WEIGHT
  - ACTIVITY TYPE AND DURATION
  - TEMPERATURE
  - DRUGS (GROWTH HORMONE, STEROIDS)
  - TRAUMA—MICRO AND MACRO
  - DISEASE SUCH AS COLLAGEN DISORDERS, INFECTION, INFLAMMATION

### PROGRESSION TO TENDONITIS/TENDONOSIS

- Mechanical stress overloads tendon
- Tissue breakdown
- Inflammatory response—vasodilation, exudation of tissue fluids, extravasation of blood, secondary reactive edema, stimulation of pain fibers, chemotaxis of cells necessary for phagocytosis of debris, increased immune response, initiation of cell division and production of the elements for early healing.

### TENDONITIS VS TENDONOSIS

- With acute TENDONITIS—inflammation causes increased permeability of cell membrane leading to connection between intra and extracellular space this leads to edema formation—>alteration of cell metabolism and extracellular stasis—residue of chronic edema leads to secondary changes in paratendinal tissue and tendon itself

### TENDONITIS VS TENDONOSIS

- Chronic edema causes fibrin to organize in the subperitenon space and forms thick, firm adhesions. The peritenon hypertrophies resulting in unhealthy nonfunctioning tissue. Tendon feels thickened and nodular and is tender to touch—TENDONOSIS. Tendon is weaker and more prone to rupture.

### TENDONITIS VS TENDONOSIS

- AS TENDONITIS CONTINUES HYPOVASCULARITY DEVELOPS AS DOES REPETITIVE MICROTRAUMA WHICH LEADS TO TENDON DEGENERATION AND WEAKENING
- HISTOPATHOLOGIC CHANGES INCLUDE MUCINOID DEGENERATION, LIPOMATOUS INFILTRATION AND POTENTIALLY CALCIFIC INFILTRATION
- GROSS APPEARANCE OF THICKENING, NODULARITY, SOFTENING AND YELLOWISH DISCOLORATION

### COMMON AREAS OF TENDONITIS


- HAND AND WRIST



Click for a more detailed view

### PROBLEM AREAS

- SHOULDER



### PROBLEM AREAS

- ELBOW



Tennis Elbow  
Lateral epicondylitis  
ulnaris & inflamed

Golfers Elbow  
Medial epicondylitis  
ulnaris & inflamed

### PROBLEM AREAS


- KNEE



Patella  
Patellar tendon  
Tibia

### PROBLEM AREAS

- FOOT AND ANKLE



**Tendons**

**Dorsal View**


- Achilles tendon
- Peroneus brevis
- Peroneus longus
- Extensor digitorum longus
- Extensor hallucis longus
- Extensor hallucis brevis

**Medial View**

- Achilles tendon
- Flexor hallucis longus
- Tibialis posterior
- Flexor digitorum longus
- Extensor digitorum longus
- Extensor hallucis brevis
- Tibialis anterior

### PROBLEM AREAS

- FOOT AND ANKLE



Achilles tendon

Inflammation of the plantar fascia can cause heel pain

Plantar fascia

#ADAM

### CLINICAL PRESENTATION

- PAIN— ESPECIALLY WITH MOTION
- WARMTH
- SWELLING
- ?CREPITUS

### TRADITIONAL TREATMENT ACUTE

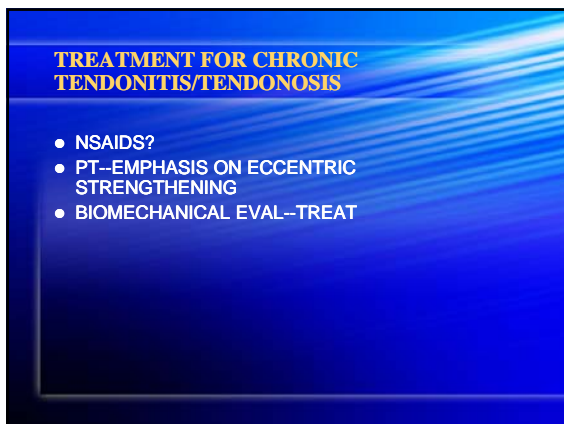
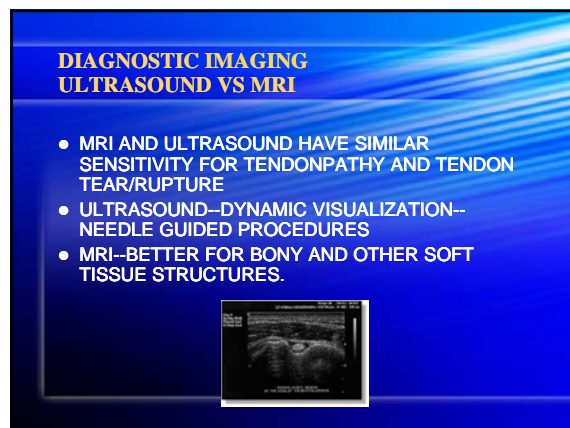
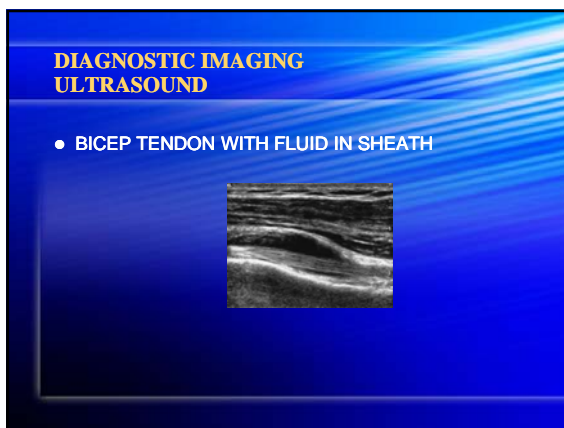
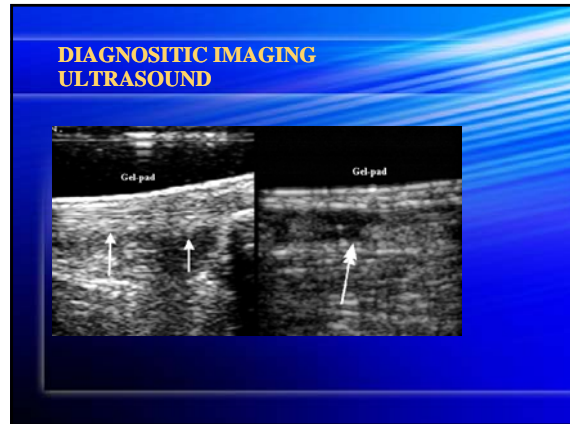
- NSAIDS
- ICE
- REST?
- PHYSICAL THERAPY
- FAILURE TO IMPROVE AFTER FOUR WEEKS OF TREATMENT---CONSIDER EARLY STEROID INJECTION---(PERITENDONOUS NOT WITHIN THE TENDON)

### TREATMENT FOR CHRONIC TENDONITIS/TENDONOSIS

- ESTABLISH DIAGNOSIS
  - MRI
  - DIAGNOSTIC ULTRASOUND

### DIAGNOSTIC IMAGING MRI





### PLATELET RICH PLASMA: A NEW TREATMENT OPTION FOR TENDONOSIS?

### PLATELET RICH PLASMA

- PLATELETS ARE SMALL MONONUCLEATED BODIES IN PERIPHERAL BLOOD THAT ARE KNOWN FOR THEIR ROLE IN HEMOSTASIS
- PLATELETS CONTAIN PROTEINS, CYTOKINES AND OTHER BIOACTIVE FACTORS THAT INITIATE AND REGULATE HEALING
- NORMAL PLASMA HAS 150,000-350,000 uL. PLATELET RICH PLASMA HAS 1,000,000uL.
- PRP HAS 3-5 FOLD INCREASE IN GROWTH FACTORS.

### PLATELET RICH PLASMA

- GROWTH FACTORS IN PRP
  - platelet-derived epidermal growth factor
  - platelet derived growth factor
  - bone morphogenic protein
  - transforming growth factor
  - insulin like growth factor
  - vascular endothelial growth factor
  - endothelial cell growth factor
  - basic fibroblast growth factor

### PLATELET RICH PLASMA

- BIOACTIVE MOLECULES FOUND IN ALPHA GRANULES IN PLATELETS
  - Adhesive proteins
  - Clotting factors
  - Fibrinolytic factors
  - Protease and antiprotease
  - Basic proteins
  - Membrane glycoproteins

### PLATELET RICH PLASMA

- PRP is made from patients own anticoagulated blood which is centrifuged twice through special filters to make PRP.
- PRP is clotted with activated platelets and leads to release of growth factors--70% released in first 10 minutes and 100% released within first hour.
- Delayed activation over 7 days can occur by making a platelet rich fibrin matrix. This is accomplished by adding CaCl<sub>2</sub> during second centrifuge.

### PLATELET RICH PLASMA

- PRP IS INJECTED INTO INJURED SITE WITH ULTRASOUND GUIDANCE.
- INJECTED AREA IMMOBILIZED FOR 2-4 WEEKS.
- POST IMMOBILIZATION REHAB FOCUSED ON ECCENTRIC STRENGTHENING (Wolf's law-- healing occurs in line of force applied to tissue)

### PLATELET RICH PLASMA

- LABORATORY STUDIES HAVE SHOWN POSITIVE EFFECTS FROM PRP
  - AFFECTS GENE EXPRESSION AND MATRIX SYNTHESIS IN TENDON CELLS
  - CELL PROLIFERATION AND TOTAL COLLAGEN PRODUCTION IS INCREASED IN HUMAN TENOCYTES
  - EQUINE--INCREASED GENE EXPRESSION IN TYPE I AND TYPE III COLLAGEN
  - RAT ACHILLES RUPTURE INCREASED TENDON CALLUS STRENGTH AND STIFFNESS
  - RAT--PATELLAR TENDON--INCREASED RECRUITMENT AND PRODUCTION OF COLLAGEN CELLS

### PRP--CLINICAL APPLICATIONS

- FOUR MAIN CATEGORIES OF USE IN MUSCULOSKELETAL MEDICINE
  - CHRONIC TENONOPATHIES
  - ACUTE LIGAMENTOUS INJURIES
  - MUSCLE INJURIES
  - INTRAOPERATIVE AUGMENTATION

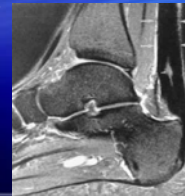
### PRP--LATERAL EPICONDYLITIS

- Mishara--15 patients underwent PRP--60% improved at 2 months, 81% at 6 months and 93% at final f/u.
- Edwards--79% success rate in treating patients with refractory lateral epicondylitis (inj whole blood not just PRP)



### PRP--ACHILLES TENDINOPATHY

- Sanchez--case control--6 patients with Achilles tear matched with 6 controls--PRP treated patients returned to activity 4-7 weeks earlier and had earlier improved ROM.



### Plantar Fasciitis

- Barrett and Erredge--reported on series of US confirmed chronic PF. Each patient underwent 3 months of conservative treatment and if symptoms continued then US guided PRP injection performed into medial PF.
- Six of nine achieved complete relief at 2 months and the three that had no relief had second injection and one of these achieved complete relief. Overall 77.9% achieved complete relief at one year.

### Patellar Tendinopathy

- Most commonly involves angiofibroblastic hyperplasia at proximal bone-tendon junction.
- Taylor injected autologous blood into patellar tendon of rabbits--histology at 6 and 12 weeks showed robust angiogenic response.
- Kajikawa--PRP into patellar tendon of rats--histology showed increase in type I and III collagen consistent with increased repair and remodeling of tendon.

### Patellar Tendinopathy



### Patellar Tendinopathy

- No prospective randomized clinical trials.
- Foster in AJSM--rec considering PRP when
  - Severe symptoms present for more than 3 months
  - Clinical findings corroborated by changes on MRI or US
  - Patient has had one week washout from NSAIDs
 Post injection protocol includes standard rehab with gradual return to activity in 6-8 weeks.

### Other Uses of PRP--Bone Healing

Some studies have been done or are in process to look at PRP impact on bone healing. Currently several histologic studies and clinical studies completed or underway that have looked at PRP impact on bone healing for nonunions or to improve or increase bony healing post surgery.

Generally results of completed studies indicate improved bony healing with PRP.

### Other Uses of PRP-- Treating Ligamentous Injuries

- Mandelbaum and Gerhardt as yet unpublished study did PRP injections into Grade II MCL sprains of professional soccer players. PRP inj group compared to control--return to play time shortened by 27%.

### Other Uses of PRP-- Acute Muscle Injury

- Cugat--presented unpublished case series--treated 16 muscle injuries in soccer and basketball players with US guided PRP.
- Return to play time decreased by 50% in grade I and II injuries (less severe)
- Some suggest caution using PRP in muscle injury as theoretic concern that increase in TGF-Beta levels from PRP may lead to more fibrotic and thus weaker healing.

### Other Uses of PRP--Intraoperative

- TKA
- ACL Repair
- Achilles Tendon Repair
- Rotator Cuff Repair
- Acute Articular Cartilage Repair

**PLATELET RICH PLASMA**

- MORE RDBPC STUDIES NEEDED
- EARLY RESULTS PROMISING
- LIMITED RISK ASSOCIATED WITH PROCEDURE
- USED FOR TREATING PATIENTS WITH NO OTHER ALTERNATIVES FOR TREATMENT OR THOSE THAT HAVE FAILED ALL OTHER TREATMENTS

**PLATELET RICH PLASMA  
A NEW TREATMENT FOR  
TREATING TENDONOSIS?**