Rotator cuff

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Supraspinatus

Abductor
견관절 운동 시 tendon이 눌린다.

Supraspinatus

Strength in full-thickness tears
67% to 81% in abduction
67% to 78% in external rotation
Partial-thickness tears
82% to 111%in abduction
No significant differences

Subscapularis

Principal dynamic ant. stabilizer in lower ranges of abduction

Infraspinatus & teres minor

Humeral head의 후방을 cover
External rotators

Point of intersection of the screw axis

Unstable Shoulder due to rotator cuff tear

The coracoacromial arch

The importance of contact and load transfer between the rotator cuff and the coracoacromial arch in the function of normal shoulders

No gap between the superior cuff and the coracoacromial arch

The spacer effect of the superior cuff tendon

Tendinous glenoid

Relative Acromial Load with Superior Humeral Load

Humeral Head Displacement Relative to Glenoid

Dynamic Functions of Rotator Cuff

Rotate the humerus

Compress the head into the glenoid

muscular balance

Provide muscular balance

Coordination

Avoid unwanted directions of motion

Anterior deltoid

기능

Forward flexion, Horizontal adduction, IR

Forward flexion 하려하면

Horizontal adduction moment

Post. Deltoid

IR moments

Infraspinatus.

Latissimus Dorsi

기능

Internal rotation, Adduction

Internal rotation 하려 할 때

Adduction moment

Superior cuff, mid-deltoid으로 조절

Adduction 하려 할 때

Internal rotation moment

Post. cuff, post. Deltoid으로 조절

Type II and III acromia

Acquired, rather than being developmental.

Yazici, Kapuz, 1995

Biomechanical Rationale for Treatment

RTC tears that are biomechanically intact

Burkhart, Orthop Clin 1997

Functional Cuff Tear

Intact force couples

Stable fulcrum kinematic pattern

Intact suspension bridge

Tear within minimal surface area

Edge stability

Burkhart, Orthop Clin 1997

Intact Force Couples

Coronal force couple

Transverse force couple

Force couples

Transverse plane force couple

Coronal plane force couple

Balanced force couple

Equal distance

Unequal distance

Kinematic Patterns

Type I - Stable Fulcrum Kinematics

Type II - Unstable Fulcrum Kinematics

Posterior Cuff Tear Pattern

Type III Captured Fulcrum Kinematcs

Type IV Unstable Fulcrum Kinematics

Subscapularis tear pattern

STABLE FULCRUM KINEMATIC PATTERN

Stable Motion

Type I

Type III

Unstable Motion

Type II

Type IV

Type I - Stable Fulcrum Kinematics

Tears of the superior rotator cuff and part of the post. cuff

Supraspinatus and part of the infraspinatus

Preservation of essential force couples in the coronal and transverse planes such that the patients had normal motion and near normal strength

Type II - Unstable Fulcrum Kinematics

Posterior Cuff Tear Pattern

All of the superior and posterior rotator cuff

Active motion consisted of little more than a shoulder shrug.

Exhibited uncoupling of the essential force couples in the coronal and transverse planes, with the inability to create a stable fulcrum for glenohumeral motion

Subscapularis Tear Pattern

Type III Captured Fulcrum Kinematcs

Type IV Unstable Fulcrum Kinematics

Type III Captured Fulcrum Kinematcs

Acromiohumeral fulcrum kinematics

Two groups

Short awning

Long awning

Long awning

Impinge on the ant. acromion

Elevation & full forward elevation

Limited

Type IV Unstable Fulcrum Kinematics

Subscapularis tear pattern

Reverse type II

All of the sup. cuff (supraspinatus) and all of the ant. cuff (subscapularis)

Post. cuff is intact

Shoulder elevation Poor

Fluroscopic finding

Subluxation in the coronal and transverse planes, with an inability to create a fulcrum for glenohumeral motion

External rotators

Intact and strong

Lift off test (+)

Loss of transverse plane force couple

Suspension bridge model

MINIMAL SURFACE AREA

Structural Engineering term

That applies to tension structure

Tents

fabric-covered airplane wings

saddle-shaped roof designs

Smallest area

Frame for this minimal surface area

The rotator cable

The arching bony attachment of supraspinatus and infraspinatus onto the greater tuberosity

EDGE STABILITY

Subacromial Edge Instability

Articular Edge Instability

CLINICAL IMPLICATIONS

FCT tears with little retraction and a redundant edge can be tacked down by a simple repair

Unrepaired tears 5 criteria

Good results with ASD & debridement

Massive irrepairable tears Partial repair to balance the forces

Partial repair of massive cuff tears

SUMMARY

RTC repair

When safely possible

Partial repair

Gives complete function

ASD and debridement

In functional RCT

Preservation of the coracoacromial arch