PATIENTS AND METHODS

Between June 2014 and April 2016, a prospective clinical study was conducted in Benha University hospital, involving twenty patients with TFCC injury without DRUJ instability with failed conservative treatment for at least 6 weeks. Wrist arthroscopy with either arthroscopic TFCC debridement or repair was done for all cases.

**Inclusion Criteria included:**
- Patients with ulnar sided wrist pain and positive TFCC compression test.
- Failed conservative treatment for at least 6 weeks in the form of above elbow immobilization and physiotherapy.

**Exclusion criteria included:**
- Skeletally immature patients.
- Previous wrist surgery or fractures.
- Wrist arthritis.
- Active infection.
- Patients refused to join the study.

**Patients Demographics:**
Age distribution

Age ranged from 18 to 54 years with a mean of 36.05 years (table 2-1).

Sex distribution

There were 14 males, and 6 females in this study (figure 2-1).

Side affected and Hand dominance

In the current study, 14 of affected wrists were left, and 6 wrists were right (figure 2-3). The right hand was the dominant hand in 16 cases, and the left hand was the dominant hand in the other 4 cases (figure 2-2). The dominant hand was affected in 6 cases while the non- dominant hand was affected in 14 cases.
History of previous trauma

Of the twenty patients in this study, fifteen patients had positive history of trauma and the other five patients didn’t recall any traumatic incident (figure 2-4).
Duration of symptoms

The duration of symptoms before proceeding to wrist arthroscopy ranged from 3 to 12 months with a mean of 7.7 months.

Preoperative evaluation:

A. Clinical evaluation

History

Careful history taking of the patients’ symptoms or disabilities was done, with special emphasis was laid on the grading of pain using VAS, what increase and what decrease pain and if the pain is with rest or with gripping and the ability to do different daily activities. History of previous trauma even minor traumatic events and the treatment received.

Clinical examination.

Inspection

Ulnar-sided wrist swelling, scars or ulnar head prominence were recorded.

Palpation

- Tenderness over bony landmarks and between the triquetrum and the ulnar styloid were recorded.
- Extensor carpi ulnaris and flexor carpi ulnaris tendinitis were excluded where the point of tenderness is along the tendons and increase with extension or flexion against resistance respectively.

Movement

Active range of motion including flexion, extension, radial and ulnar deviation, supination and pronation were measured and compared to the normal side using goniometer.
**Grip strength**

Grip strength was measured with a dynamometer and compared with the normal side. Each grip measurement was recorded three times in a standardized manner and an average value was calculated. Grip strength data was reported as percentage of strength compared with the contralateral healthy wrist.

**Special tests**

- **The TFCC compression** was positive in all cases.
- **The piano key test** was compared to the opposite side and was negative in all cases.

**B. Radiological evaluation:**

- **Plain X-Ray PA** (with the shoulder abducted 90 and elbow flexed 90), Lateral and clenched fist views were done for all patients.

All cases were assessed regarding ulnar variance and the distribution was as follow (figure 2-5):

- 15 cases were found to have neutral radio-ulnar variance.
- 4 cases were found to have positive ulnar variance.
- 1 case was found to have negative ulnar variance.

![Ulnar variance](image)

Figure (2-5) Pie chart showing ulnar variance distribution in the study group.

- **MRI** was done in all cases to diagnose TFCC lesions.
Assessment of outcome:

Visual analogue scale (VAS) for pain was completed by all patients preoperatively and postoperatively. It is composed of 10 point chart with 0 no pain at all and 10 is severe untolerable pain.

Two scoring systems were used in this study to assess subjective and objective outcomes; DASH score (Disability of Arm, Shoulder and Hand) score(153) (table 2-2) and MMWS (Modified Mayo Wrist Score)(153)(table 2-3).

**DASH score**

The disabilities of the arm, shoulder and hand (DASH) questionnaire is a self-administered region-specific outcome instrument developed as a measure of self-rated upper-extremity disability and symptoms. The DASH consists mainly of a 30-item disability/symptom scale, scored 0 (no disability) to 100 (maximum disability)(153).

**Mayo modified wrist score (MMWS)**

This consists of subjective parameters (pain and function) and objective parameters (motion and grip strength). The overall rating (total of subjective and objective score), between (91-100) is ranked excellent, (80- 90) good, (65-79) fair, and (<65) poor(153).

Table (2.2) DASH score(153)
<table>
<thead>
<tr>
<th>Position</th>
<th>Name</th>
<th>Age</th>
<th>Gender</th>
<th>Degree</th>
<th>Experience</th>
<th>Salary</th>
</tr>
</thead>
<tbody>
<tr>
<td>Manager</td>
<td>John</td>
<td>40</td>
<td>Male</td>
<td>MBA</td>
<td>10 years</td>
<td>$80k</td>
</tr>
<tr>
<td>Engineer</td>
<td>Jane</td>
<td>28</td>
<td>Female</td>
<td>BS</td>
<td>5 years</td>
<td>$60k</td>
</tr>
<tr>
<td>Designer</td>
<td>Joe</td>
<td>35</td>
<td>Male</td>
<td>MS</td>
<td>7 years</td>
<td>$70k</td>
</tr>
</tbody>
</table>

**Salary Breakdown**

- Base Salary: $70k
- Bonus: $5k
- Insurance: $3k
- Retirement: $10k

**Benefits**

- Health insurance
- Dental insurance
- Vision insurance
- 401(k) plan
- Paid vacation
- Paid sick leave
- Life insurance

**Notes**

- John has been with the company for 10 years and has a MBA in Business Administration.
- Jane has a BS in Engineering and has been with the company for 5 years.
- Joe has a MS in Design and has been with the company for 7 years.

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**Company Policies**

- Schedule: 8:00 AM - 5:00 PM
- Office Policy: No food or drink in the office
- Dress Code: Business casual
- Equipment: Laptop, Desktop, Mobile Phone

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**Employee Handbook**

- Page 1 - Introduction
- Page 2 - Company Overview
- Page 3 - Employment Policies
- Page 4 - Benefits
- Page 5 - Emergency Contact Information
- Page 6 - Code of Conduct
- Page 7 - Confidentiality Agreement
- Page 8 - Termination Process
- Page 9 - Grievance Procedure
- Page 10 - Health and Safety Information

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**Contact Information**

- Human Resources: HR@company.com
- Finance Department: Finance@company.com
- Operations Department: Operations@company.com

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**Company Mission**

Our mission is to provide high-quality products and exceptional customer service to our clients. We strive to foster a diverse and inclusive workplace where employees can grow and develop their skills.

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**Company Vision**

We envision becoming the leading provider of innovative solutions in our industry. We aim to achieve this by continuously improving our products and services and by fostering a culture of innovation and excellence.

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**Company Values**

- Integrity
- Excellence
- Innovation
- Collaboration
- Responsibility

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**Employee Feedback**

We value your feedback and suggestions. Please feel free to contact us with any comments or concerns you may have.

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### Table (2-3): Mayo Modified Wrist Score(153)

<table>
<thead>
<tr>
<th>Category</th>
<th>Score</th>
<th>Findings</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Subjective parameters</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pain</td>
<td>25</td>
<td>No pain</td>
</tr>
<tr>
<td></td>
<td>20</td>
<td>Mild occasional</td>
</tr>
<tr>
<td></td>
<td>15</td>
<td>Moderate</td>
</tr>
<tr>
<td></td>
<td>0</td>
<td>Severe</td>
</tr>
<tr>
<td>Work Status</td>
<td>25</td>
<td>Regular job</td>
</tr>
<tr>
<td></td>
<td>20</td>
<td>Restricted job</td>
</tr>
<tr>
<td></td>
<td>15</td>
<td>Able to work but unemployed</td>
</tr>
<tr>
<td></td>
<td>0</td>
<td>Unable to work due to pain</td>
</tr>
<tr>
<td><strong>Objective measurements</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Motion</td>
<td>25</td>
<td>&gt;120</td>
</tr>
<tr>
<td></td>
<td>20</td>
<td>100 to 119</td>
</tr>
<tr>
<td></td>
<td>15</td>
<td>90 to 99</td>
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<tr>
<td></td>
<td>10</td>
<td>60 to 89</td>
</tr>
<tr>
<td></td>
<td>5</td>
<td>30 to 59</td>
</tr>
<tr>
<td>Grip strength (% of normal)</td>
<td>25</td>
<td>90 to 100</td>
</tr>
<tr>
<td></td>
<td>15</td>
<td>75 to 89</td>
</tr>
<tr>
<td></td>
<td>10</td>
<td>50 to 74</td>
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<td>5</td>
<td>25 to 49</td>
</tr>
<tr>
<td></td>
<td>1</td>
<td>0 to 24</td>
</tr>
</tbody>
</table>
Operative Technique

**Instruments:**

The arthroscopic unit used consists of (Fig 2-6):

- Videoscope camera, light source, and monitor.
- 2.7 mm 30-degree lens and its sheath with two side ports.
- Arthroscopic manual instruments (probes, baskets, and graspers).
- Motorized instruments with shaver and Burr/abrader.
- Irrigation bags with their tubing. Arthroscopic pump was used to distend the joint, and offer bleeding control.
- No. 11 scalpel blade.

Fig. 2-6 Arthroscopic instruments used in wrist arthroscopy
**Anesthesia:**

General anaesthesia was used in all patients.

**Positioning of the patient**

All patients were operated upon in supine position. The patient lies supine with the shoulder over the edge of the operating table. The shoulder is abducted to 90° and the elbow flexed to 90° on a side table and traction tower is used for wrist joint distraction (Fig 2-7).
**Marking the bony landmarks**

Marking the bony landmarks was done after traction. The Lister tubercle is the bony landmark that is used to identify the portals used for wrist arthroscopy (Fig 2-8).

**Portal establishment**

After the landmarks have been identified and marked on the skin, the standered 3, 4 portal location is identified. A needle was introduced in the 3, 4 portal just 0.5 cm distal to the lister tubercle. The needle was removed and the skin is incised longitudinally with the tip of a no. 11 blade. A mosquito hemostat was used to dissect bluntly down to enter the joint (Fig 2-9).

![Fig. (2-8): Skin marking for bony landmarks and Portals for radiocarpal and midcarpal joints.](image)

![Fig (2.9): establishment of 3,4 portal](image)
The arthroscopic sheath with a blunt trocar for the 2.7mm arthroscope was passed along the same course as the needle, just distal to the lister tubercle. This was followed by the introduction of the arthroscope. The 6R portal was then done just radial to the extensor carpi ulnaris tendon after identification using a needle followed by introduction of the probe.

**Diagnostic dry arthroscopy:**

Initially diagnostic dry arthroscopy was done, and it was found to be more accurate in detecting the different lesions inside the wrist joint.

**Arthroscopy of the radiocarpal joint:** (fig 2-10 a, b)

Diagnostic arthroscopy was done including routine examination of the following:

- The articular surface of the scaphoid fossa of the radius and the corresponding scaphoid articular surface.
- The lunate fossa of the radius and the corresponding lunate articular surface.
- The volar radiocarpal ligament and the Scapholunate ligament.

**Arthroscopy of The Ulnocarpal joint**

Then the scope was moved ulnarily to the ulnocarpal joint and the following was inspected:

- The TFCC detecting the integrity of the disc using trampoline test (Fig 2-11), the integrity of deep fibers using the hook test, and if there is any TFCC lesion,
it should be accurately defined regarding its site, the stability of the TFCC and associated lesions such as chondromalacia of the lunate.

- The lunotriquetral ligament was also inspected for any partial or complete tears.
- The ulnocarpal joint was also inspected for any synovitis.
- The arthroscope was then switched to 6R portal and the TFCC tear was graded according to classification systems.

In the current study, there was 19 cases with traumatic 1B TFCC lesions without DRUJ instability that were managed by transcapsular repair, and 1 case traumatic 1A TFCC lesion that was managed by shaver debridement.

**Treatment of traumatic 1B TFCC lesion using transcapsular repair**

**Technique:**

After identification of the tear (fig. 2.12), debridement of synovium and refreshing tear edges was done through 6R portal using motorized shaver (fig. 2.13). All tears were repaired by 2 vertical matress sutures with the palmer suture done first.

A 20 gauge needle loaded with PDS loop was inserted 1cm proximal to joint line and volar to the ulnar styloid aiming to exit just radial to the tear piercing the capsule and taking bite through the TFCC (fig. 2.14), the loop is held by a grasper through the 6R portal and the 1st needle is withdrawn outside (fig. 2.15). The second needle was inserted distal to the first one piercing the capsule and taking a bite through the torn TFCC and directed inside the loop of the first needle then the PDS suture was advanced through the second needle into the joint (fig. 2.16). The loop was then withdrawn acting as a shuttle to pull the intra-articular 2nd suture outside (fig. 2.17 a, b).
The process was repeated in the dorsal suture (fig. 2.18) then the strands of both stitches were pulled simulating the repair and the repaired TFCC was examined using a probe.

2 cm longitudinal incision is made on the ulnar side of the wrist just volar to ECU between the palmer and dorsal stitches (fig. 2.19). Blunt dissection with a right-angled clamp is used to identify and protect any branches of the dorsal sensory branch of the ulnar nerve within the field, and dissection is carried down to the retinaculum. Both ends of each paired suture are sequentially rerouted such that the knot will lie directly on retinaculum with no interposed subcutaneous tissue or potential nerve branches (fig. 2.20) and then the knots are sequentially tied (fig. 2.21). Standard closure of the ulnar incision and arthroscopy portals is performed.

Fig 2.12 TFCC tear identified

Fig 2.13 Debridement of tear edges
Fig 2.14 1st needle loaded with PDS

Fig 2.15 Loop is held with a grasper

Fig 2.16 2nd needle loaded with a single strand of PDS and passed through the loop

Fig 2.17 a The loop is then withdrawn acting as a shuttle to pull the intra-articular 2nd suture outside

Fig 2.17 b Suture tightened
Postoperative care and rehabilitation:

- The patient leaves the operation room in a long-arm splint in full supination and 20 degree extension for the first 3 weeks.
- Week 3-5 → long arm splint was converted to short arm splint to allow for gentle rotation (supination to neutral).
- Week 5-6 → progressive rotation to 60 degrees pronation to reach full
rotation by week 6.
- Week 6-10 → discontinue splint completely except for at risk activities and progress with passive and active wrist ROM.
- Week 10-12 → light strengthening is permitted.
- Week 12-16 → allow full weight bearing and full activities.

treatment of traumatic 1A TFCC lesion using arthroscopic debridement

- The strategy in management of other traumatic lesions of the TFCC palmer IA (Fig 2-22) is debridement. The margin of the TFCC was smoothed and beveled following the central disc resection in IA TFCC lesion.

With the scope in the 3-4 portal, the radial side of the TFCC may be resected, using the ulnar-side portal. A grasper is used in outlining and excising the torn fibers of the TFCC.

Next, the scope is placed in the ulnar-side portal, and the cutting instrument is inserted through the 3-4, and the ulnar side of the tear is resected.
• This is followed by shaving the edges of the tear the edges are debrided till we have a stable rounded TFCC.

**Postoperative care:**

Postoperative care in these patients was 1-2 weeks in below elbow splint followed by physiotherapy.