



**FOCAL SHOCKWAVES: A MULTICENTRIC STUDY**

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International Federation of Orthopedics and Traumatology Specialist

Shockwaves Treatment President Campus Biomedico University - Rome

**IFSWT**  
International Federation of Shock Wave Treatment

*Welcomes Italy*

Lessons learned at the Italian Congress for the Study of Focused Shock Waves (FST)  
July 1st, 7pm (Italy)

With the participation of the orthopedic and traumatology services of the universities of Bologna, Tor Vergata, UniMoRe and Magna Graecia.

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PRESIDENT OF INTERNATIONAL FEDERATION OF SHOCK WAVE TREATMENT.

**13 E 14 DE NOVEMBRO**  
RIO DE JANEIRO/RJ

**XXXIII**  
**CURSO DE CERTIFICAÇÃO EM TRATAMENTO POR ONDAS DE CHOQUE**

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17 e 18 de Agosto de 2024  
São Paulo - Brasil

**1° WORLD CONGRESS ON SHOCKWAVE TREATMENT**

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# FST-Calcific, non Calcific, with Lesions and without Lesions Tendinopathies

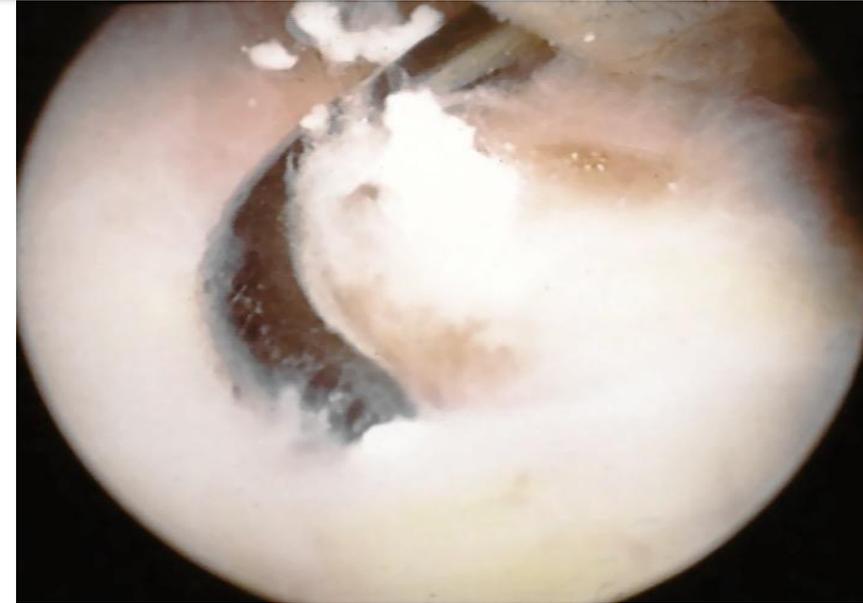
G. Gasparini  
G. Carlisi  
A. Di  
Giorno

Policlinico Universitario Mater Domini  
Clinica Ortopedica Università Magna Graecia  
Direttore Prof. Giorgio Gasparini  
Scuola Specializzazione Ortopedia Traumatologia  
Direttore Prof. Giorgio Gasparini

# Calcific tendinopathies

**Formative phase**

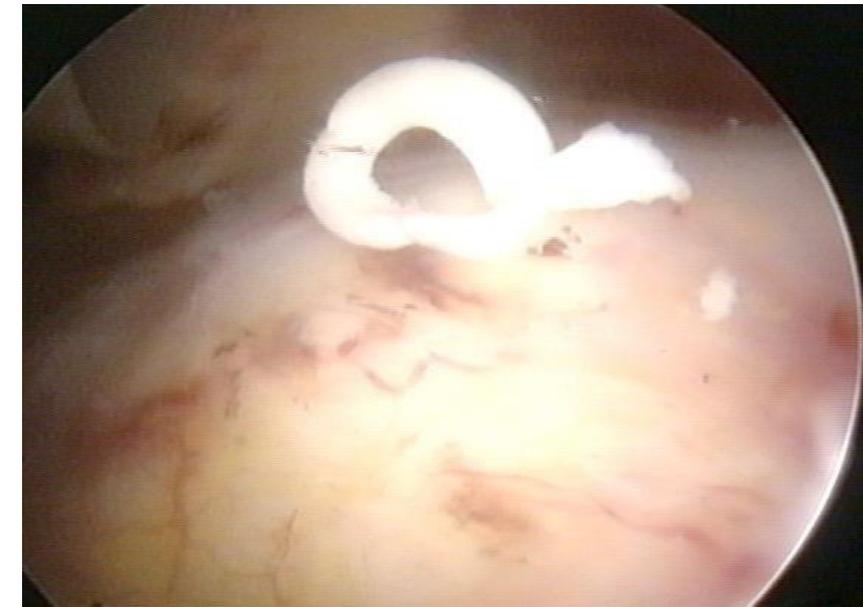
**“chalk”**



**Resorption phase**

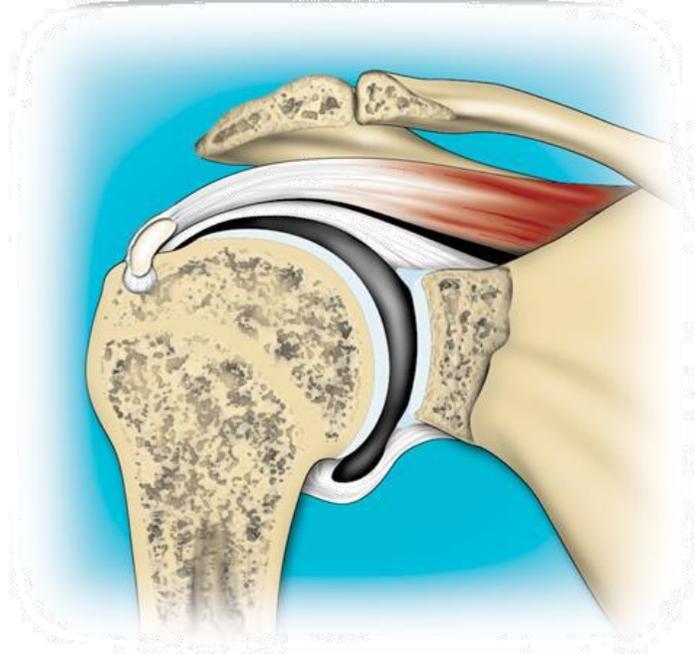


**“cheese”**



**Tendon repair phase**

# Calcific tendinopathies



**-Size**

**- Number**

**- Position**

**- Phase**



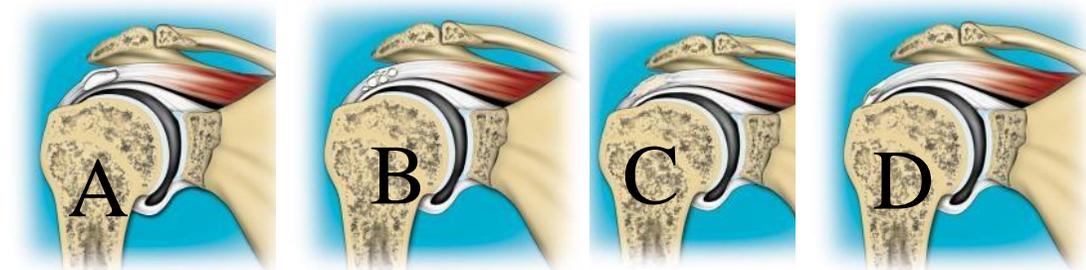
**Associated conditions:**

- SLAP
- Cuff tear
- CLBO
- Instability
- AC arthrosis



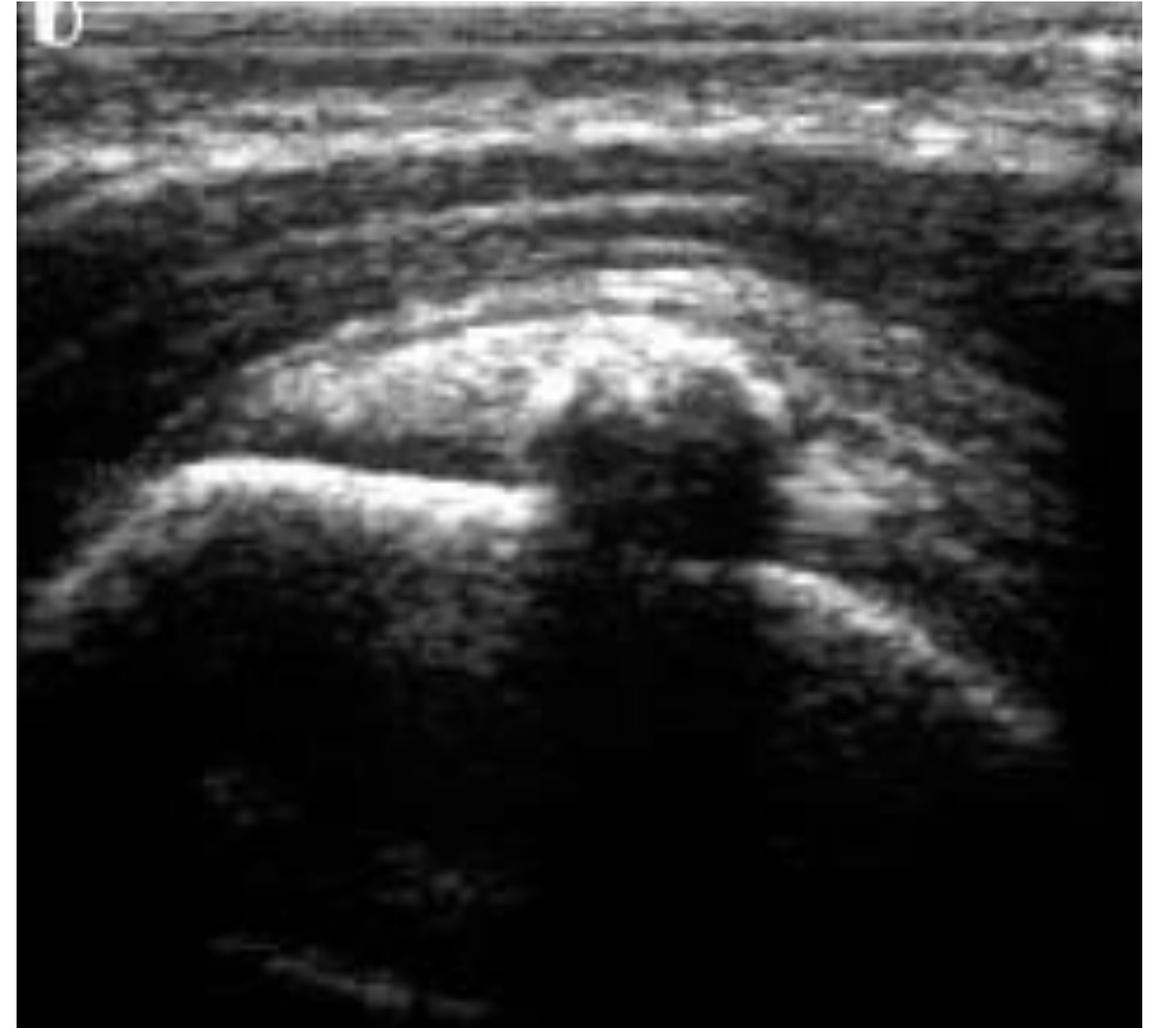
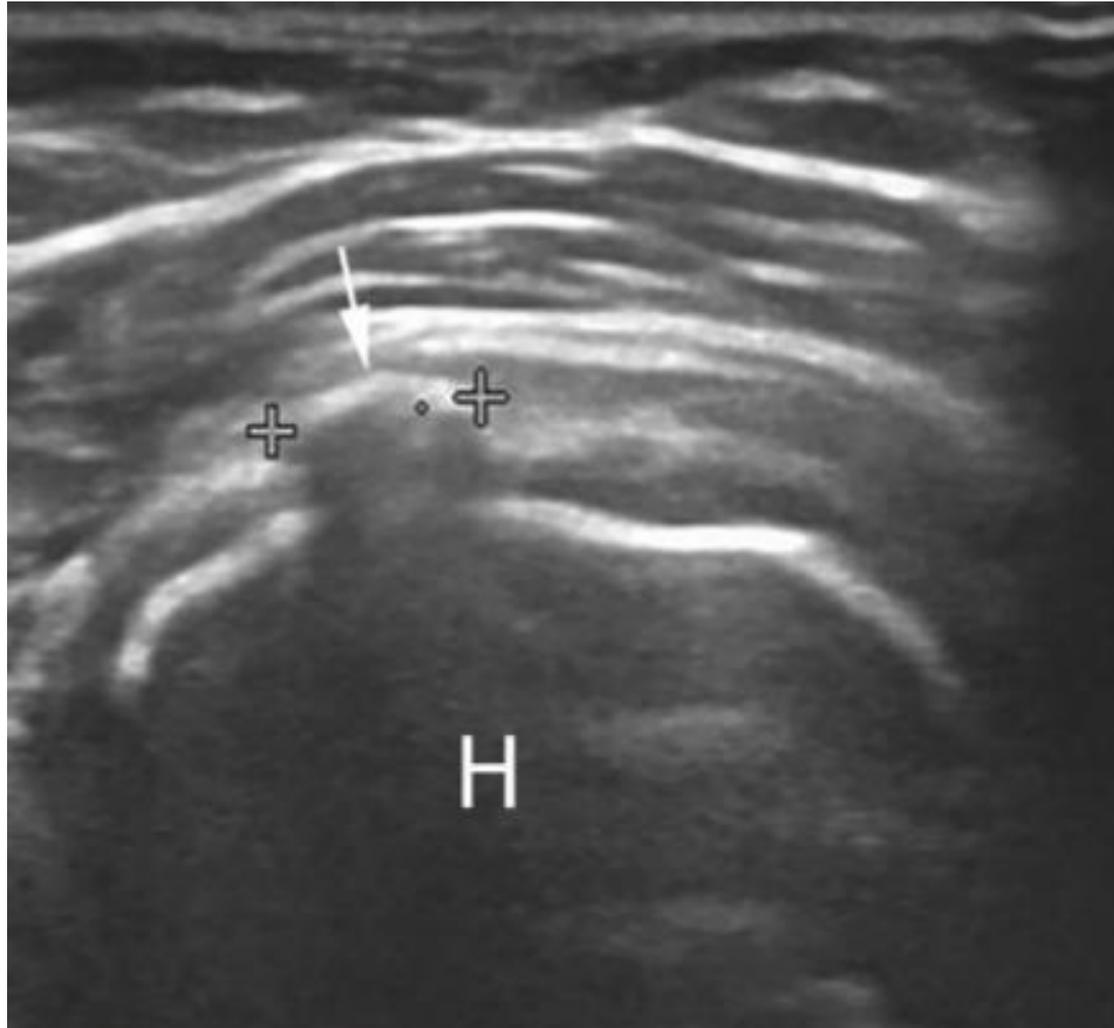
# Classification

Author	Subtype	Description
Bosworth	Small	<0.5 cm
	Medium	0.5–1.5 cm
	Large	1.5 cm
DePalma et al.	Type I	Fluffy, amorphous and ill defined
	Type II	Defined and homogeneous
Molè et al. (French Arthroscopy Association)	Type A	Dense, rounded, sharply delineated
	Type B	Multilobular, radiodense, sharp
	Type C	Radiolucent, heterogeneous, irregular outline
	Type D	Dystrophic calcific deposit
Gartner et al.	Type I	Well demarcated, dense
	Type II	Soft contour/dense or sharp/transparent
	Type III	Soft contour/translucent and cloudy



Molè, Kempf 1993

# Ultrasound evaluation



# MRI Evaluation



## Greater tuberosity osteolysis

J Shoulder Elbow Surg (2009) ■, 1-6



JOURNAL OF  
SHOULDER AND  
ELBOW  
SURGERY  
www.elsevier.com/locate/jse

### Osteolytic lesion of greater tuberosity in calcific tendinitis of the shoulder

Giuseppe Porcellini, MD\*, Paolo Paladini, MD, Fabrizio Campi, MD, Francesco Pegreff, MD

Unit of Shoulder and Elbow Surgery, D. Cervesi Hospital, Cattolica (RN), Italy

**Summary** This study investigated tuberosity osteolysis, an uncommon and frequently misdiagnosed form of calcific tendinitis of the shoulder, and evaluated its effects on clinical and surgical outcomes. A total of 126 patients with calcific tendinitis studied with radiographs, ultrasound, and magnetic resonance images (MRI) were divided into groups positive and negative for tuberosity osteolysis and treated by arthroscopy. Follow-up evaluation was at 2 years, using the Constant score. Tuberosity osteolysis was associated with significantly lower Constant scores, both before and after surgical treatment. Clinical and imaging findings exhibited a significant correlation. A 100% correlation was found between arthroscopy and MRI findings of tuberosity osteolysis compared with 90% with radiographs. Imaging and functional data indicate that calcific tendinitis of the rotator cuff with tuberosity osteolysis is a distinctive form of calcific tendinitis that should be considered in clinical and surgical practice.

© 2009 Journal of Shoulder and Elbow Surgery Board of Trustees.

Calcific tendinitis, a condition characterized by multifocal, cell-mediated calcification of viable tissue, affects a significant number of patients with shoulder complaints.<sup>21</sup> Hypoxia, microtrauma, and disuse have been suggested as causative factors, but its etiology remains unclear.<sup>10-19</sup> It may be an incidental finding in an asymptomatic shoulder (3% to 20%), or it may be the cause of pain (7%), often bilateral (13% to 47%), with a predilection for the right shoulder.<sup>1</sup> Women are affected slightly more frequently than men.<sup>1</sup> The propensity for the supraspinatus tendon (51%), just medial to the greater tuberosity, is still unexplained; the infraspinatus (44.5%), teres minor (23.3%), and subscapularis (3%) tendons are less commonly affected.<sup>1,7,17</sup>

According to Ulthoff and Loehr,<sup>20</sup> the disease progresses through correlating pathologic and clinical stages. The initial phase of deposit formation is rarely symptomatic. The acute symptoms are usually associated with the resorptive phase, where vascular invasion, an influx of phagocytic cells, and edema raise intratendinous pressure.<sup>22</sup> Symptoms may become chronic.

Conservative treatment with anti-inflammatory drugs, steroids, nonsteroid drugs (NSAIDs), local injection of anesthetic, and needling is frequently successful.<sup>6,9,13,24</sup> Extracorporeal shock wave (ECSW) therapy is effective in selected patients and has minimal complications.<sup>3,18,23</sup> Radiation therapy is increasingly used less because of its potential for adverse consequences.<sup>14</sup> Arthroscopic treatment of chronically painful calcific tendinitis of the rotator cuff, resistant to conservative or semi-invasive treatment (needling), is successful in more than 90% of patients.<sup>3,19</sup>

Some authors have described a different disease course<sup>3</sup> with a longer duration of painful symptoms and a reduction



\*Reprint requests: Giuseppe Porcellini, MD, Unit of Shoulder and Elbow Surgery, D. Cervesi Hospital, Via L.V. Beethoven 1, 47841 Cattolica (RN) Italy.

E-mail address: chirurgiaspalla@virgilio.it (G. Porcellini).

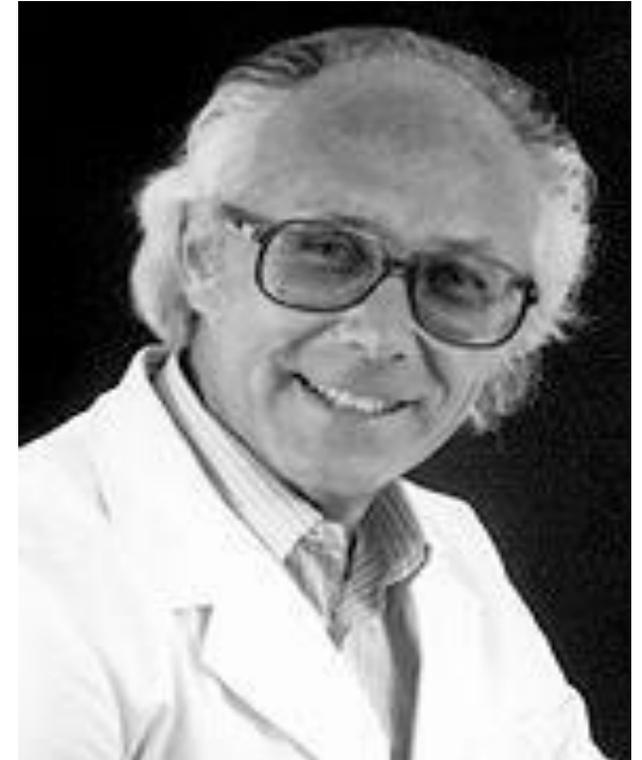
# Treatment



**Conservative treatment**

**90%**

**Good outcomes**



**Gschwend 1981**

# Treatment



## Conservative treatment:

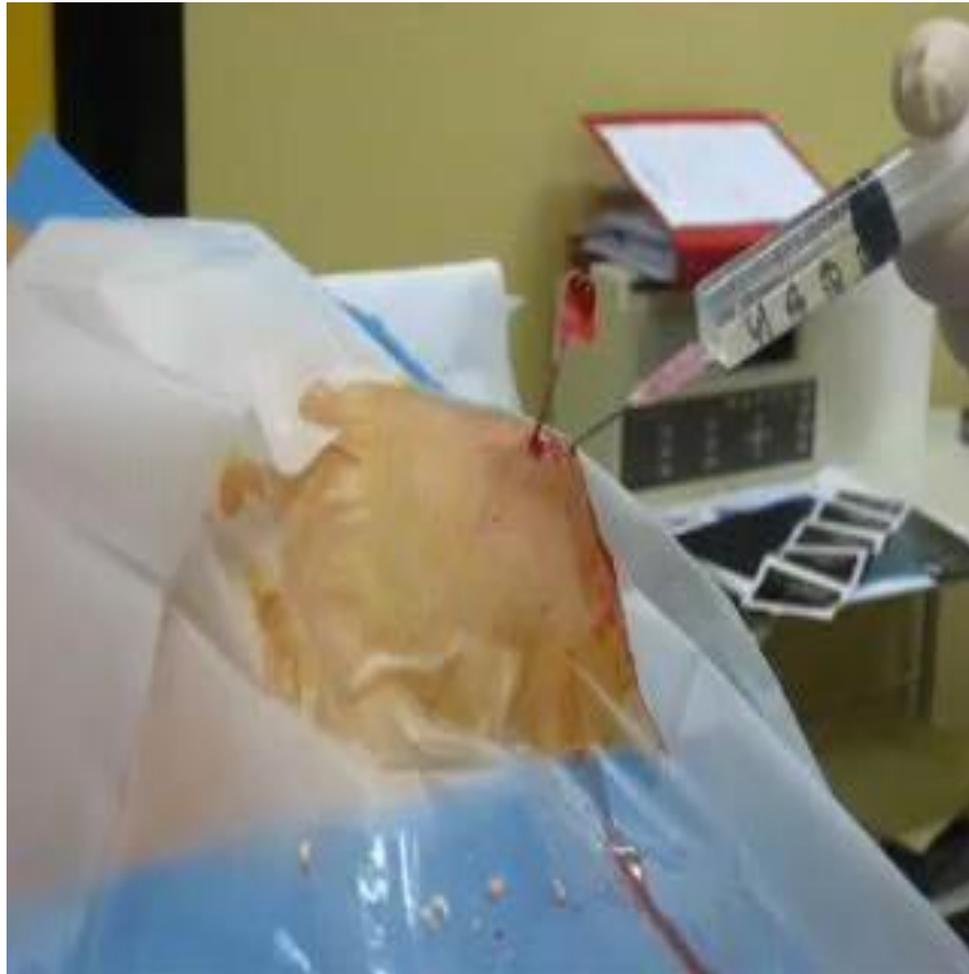
- FANS
- Steroid injections
- Needling
- ESWT

## Surgical treatment

- **arthroscopy procedure** reserved for chronic cases that have not responded to conservative treatment

# Needling

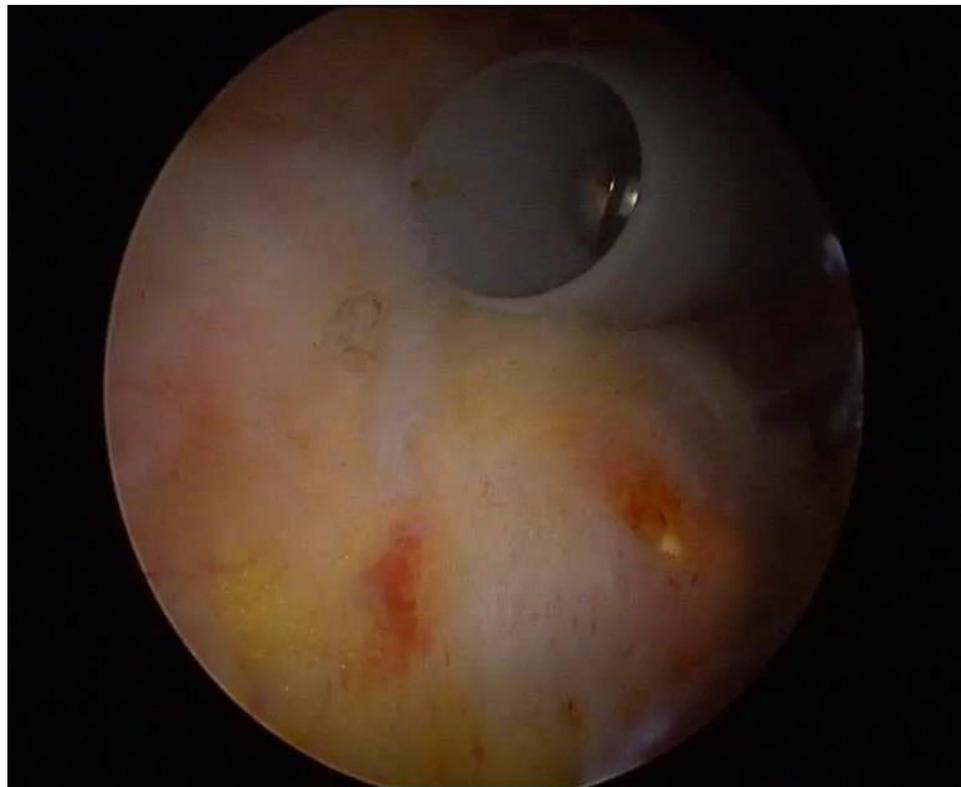
## Acute phase



# Arthroscopic treatment (Chronic

## Arthroscopic treatment of calcifying tendinitis of the shoulder: Clinical and ultrasonographic follow-up findings at two to five years

Giuseppe Porcellini, MD, Paolo Paladini, MD, Fabrizio Campi, MD, and Massimo Paganelli, MD, *Forlì, Italy*



**In case of failure of  
conservative  
treatment**

# ESWT



Best statistically results in **ESWT VS PLACEBO**

*Wang (2003) Gerdesmeyer (2003)*

Reduction of pain and improvement of functional outcomes in more **90%**

*Malliaropoulos (2017) Pan (2003)*

Reduction in number and size of calcification in **40-60%**

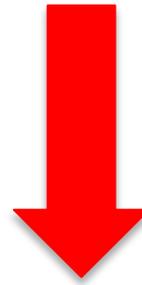
*Rebuzzi (2008) Cosentino (2003) Wang (2003)*

Overlapping clinical outcomes between **surgery and ESWT** (in early stage)

*Rompe (2011) Rebuzzi (2008)*



## 158 calcific tendinopathies



- 71% Complete resorption of calcification
- Short and long term antalgic control
- Good functional outcomes

# Calcific tendinopathies -



## 158 patients

Divided into 2 groups according to the size:

**Group A:** 88 calcification < 15mm

**Group B:** 70 calcification > 15mm



## Prognostic factors for the outcome of extracorporeal shockwave therapy for calcific tendinitis of the shoulder

W-Y Chou <sup>1</sup>, C-J Wang <sup>1</sup>, K-T Wu <sup>1</sup>, Y-J Yang <sup>1</sup>, J-Y Ko <sup>1</sup>, K-K Siu <sup>1</sup>

Author	Subtype	Description
Bosworth	Small	<0.5 cm
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	Type D	Dystrophic calcific deposit
	Type I	Well demarcated, dense
	Type II	Soft contour/dense or sharp/transparent
Gartner et al.	Type III	Soft contour/translucent and cloudy

# Calcific tendinopathies - ES



## Ultrasound evaluation:

- Position
- Morphological characteristics

## Subdivision into subgroups

”arc-shaped / non arc-shaped”

**Group A1: 45** < 15mm non arc-shaped

**Group A2: 43** < 15mm arc-shaped

**Group B1: 36** > 15mm non arc-shaped

**Group B2: 34** >15mm arc-shaped

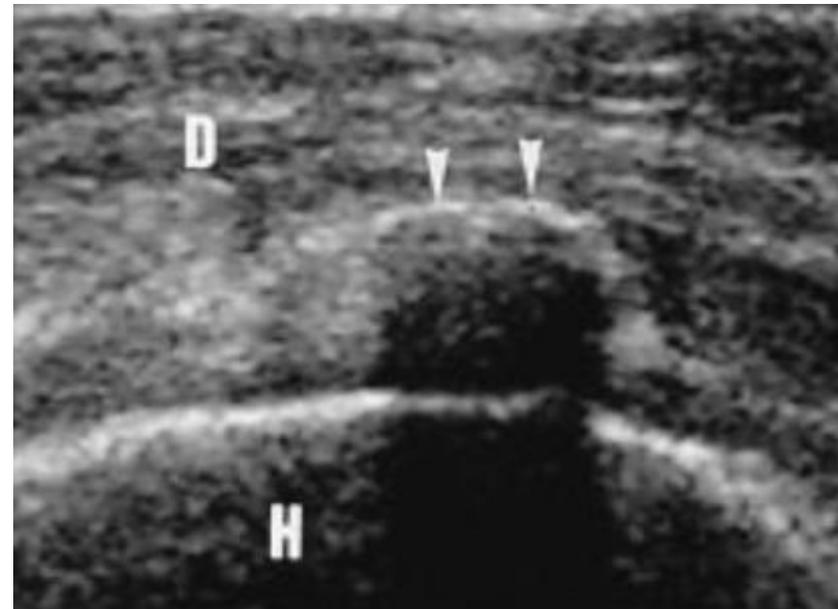
> [Ultrasound Med Biol.](#) 2001 Jun;27(6):735-43. doi: 10.1016/s0301-5629(01)00353-2.

## The role of high-resolution ultrasonography in management of calcific tendonitis of the rotator cuff

H J Chiou <sup>1</sup>, Y H Chou, J J Wu, T F Huang, H L Ma, C C Hsu, C Y Chang

Affiliations + expand

PMID: 11516532 DOI: [10.1016/s0301-5629\(01\)00353-2](#)



# Protocol - ESWT



## Treatment protocol:

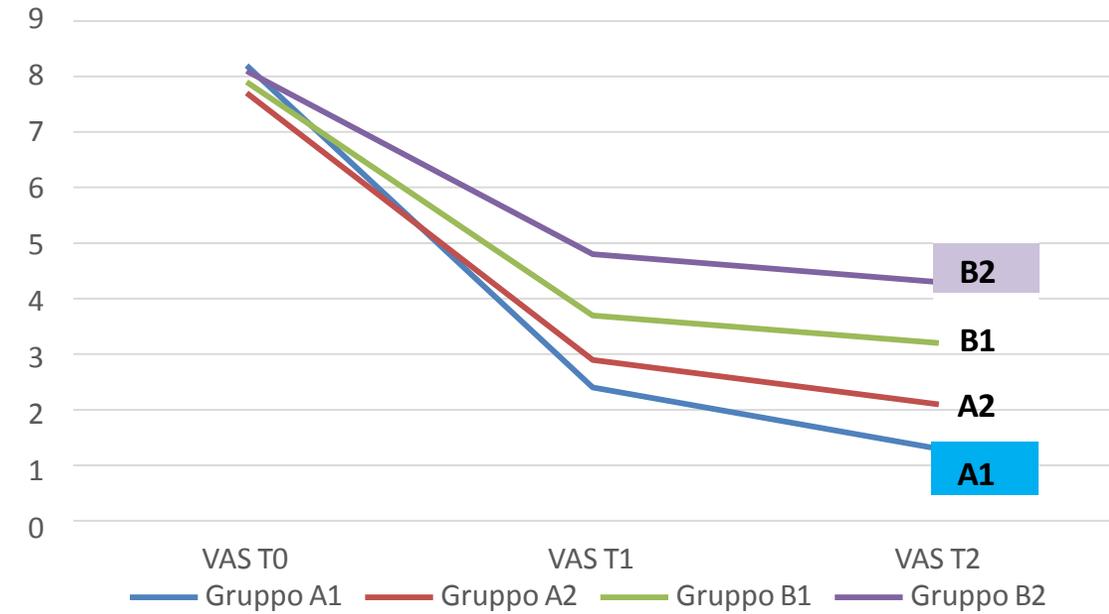
- 6 sessions
- 7-day interval between sessions
- No pre-treatment local anesthesia
- 3000 pulses with *Energy Flux Density* between 0,10 e 0,20 mJ/ mm<sup>2</sup>
- Average frequency 5Hz
- Ultrasound during treatment

# Clinical Results - ESWT



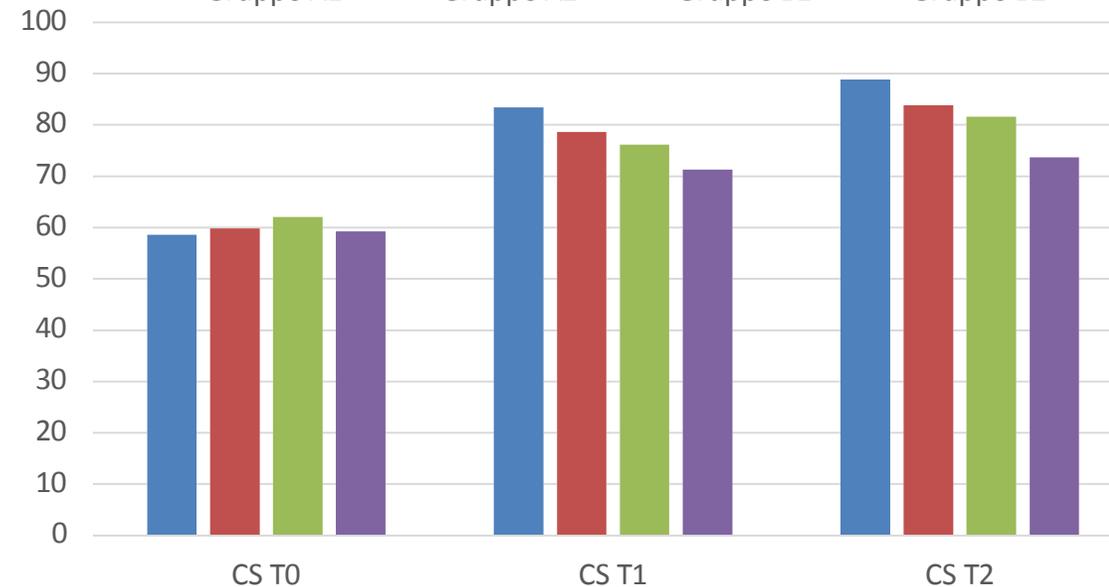
## (VAS)

	N°	VAS T0	VAS T1	VAS T2
GROUP A1	45	8,2 (s=1,19)	2,4 (s=0,99)	1,3 (s=0,92)
GROUP A2	43	7,7 (s=1,04)	2,9 (s=1,18)	2,1 (s=1,05)
GROUP B1	36	7,9 (s=1,16)	3,7 (s= 1,23)	3,2 (s= 1,13)
GROUP B2	34	8,1 (s=1,18)	4,8 (s=1,05)	4,3 (s=1,21)



## (Constant Score)

	N°	CS T0	CS T1	CS T2
GROUP A1	45	58,6 (s=4,96)	83,4 (s=6,29)	88,76 (s=3,86)
GROUP A2	43	59,8 (s=3,91)	78,6 (s=4,18)	83,87 (s=2,71)
GROUP B1	36	62,1 (s=3,89)	76,2 (s= 2,81)	81,64(s= 2,58)
GROUP B2	34	59,3 (s=3,77)	71,3 (s=3,82)	73,73 (s=3,06)

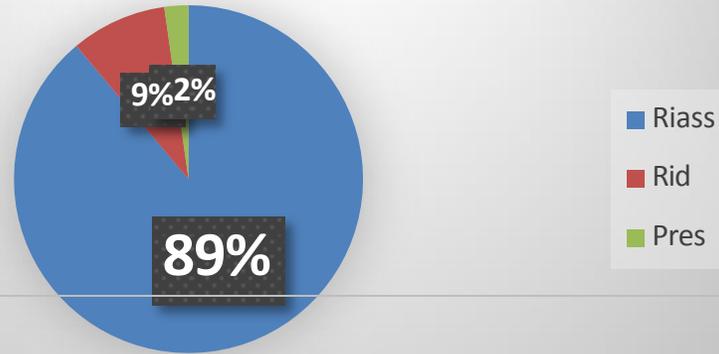


# US results - ESWT

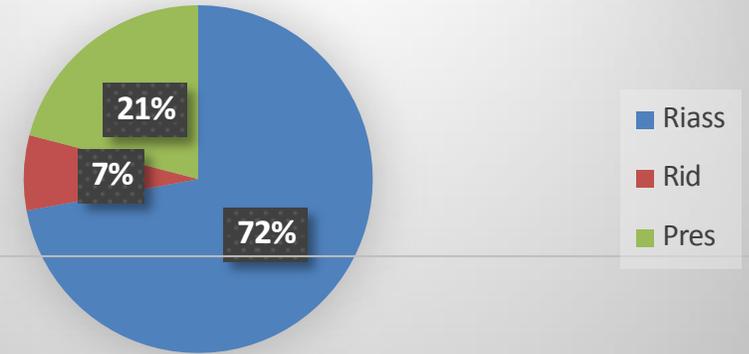


## US Follow-up at 6 months

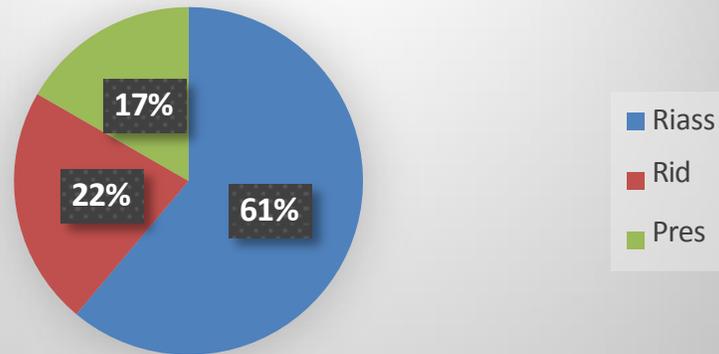
### Group A1



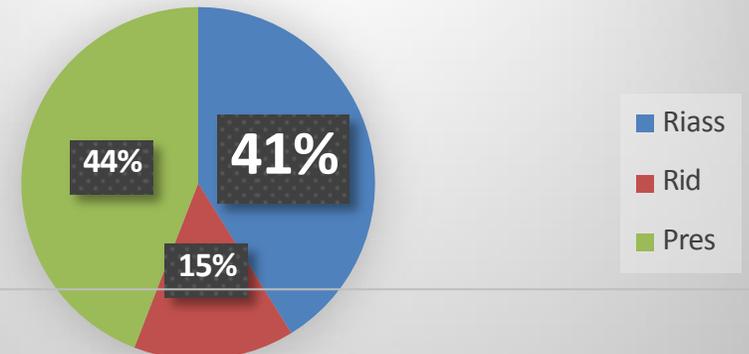
### Group A2



### Group B1



### Group B2



# Conclusion - ESWT

- Calcification size ( $>15\text{mm}$ ) is the main prognostic factor
- The ''arc-shaped'' ultrasound form results in a percentageally higher rate of nonresorption
- Unsatisfactory results if these 2 conditions are associated



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# FOCAL SHOCKWAVES : A MULTICENTRIC STUDY.



SAPIENZA  
UNIVERSITÀ DI ROMA

# Lessons learned at the Italian Congress for the Study of Focused Shock Waves (FST)

## Medial and Lateral Epicondylitis

S. Gumina, M. Cantore, V. Candela, A. Di Giorno

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## Lateral elbow tendinopathy (tennis elbow)

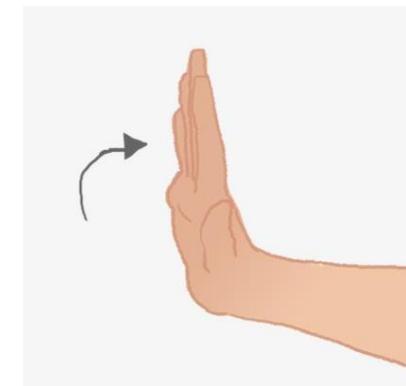
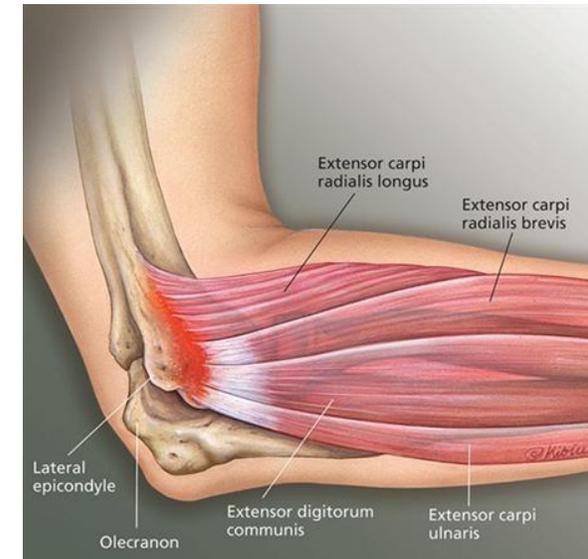
The tendon most frequently involved is the **EXTENSOR CARPI RADIALIS BREVIS (ECRB)**

### Incidence

- Most common cause for elbow symptoms in patients with elbow pain
- Affects 1-3% of adults annually
- Commonly in dominant arm

### Demographics

- Up to 50% of all tennis players develop
- Common in laborers who utilize heavy tools
- Workers engaged in repetitive gripping or lifting tasks
- Most common between ages of 35 and 50 years old
- Men and women equally affected



## Most common cause of lateral elbow pain

## Medial elbow tendinopathy (golfer's elbow)

The medial joint tendon is affected and the **ROUND PRONATOR** as well as the **FLEXOR RADIALIS CARPI** belong to this group of muscles.

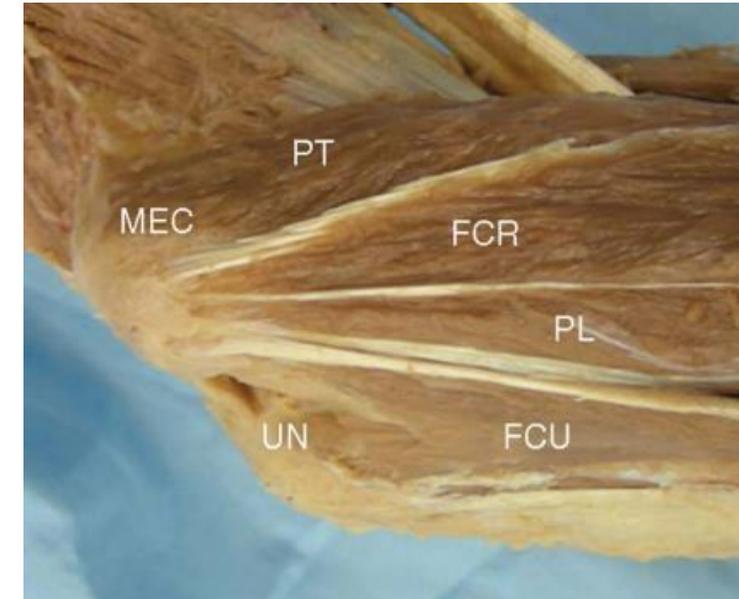
### Incidence:

- 5 to 10 times less common than lateral epicondylitis

### Demographics

- affects men and women equally
- dominant extremity in 75% of cases
- age 30s to 60s, most commonly in 30s to 40s

**Most common cause of medial elbow pain**



# Focused shock waves in musculoskeletal pathology – Epicondylitis and Epitrocleitis



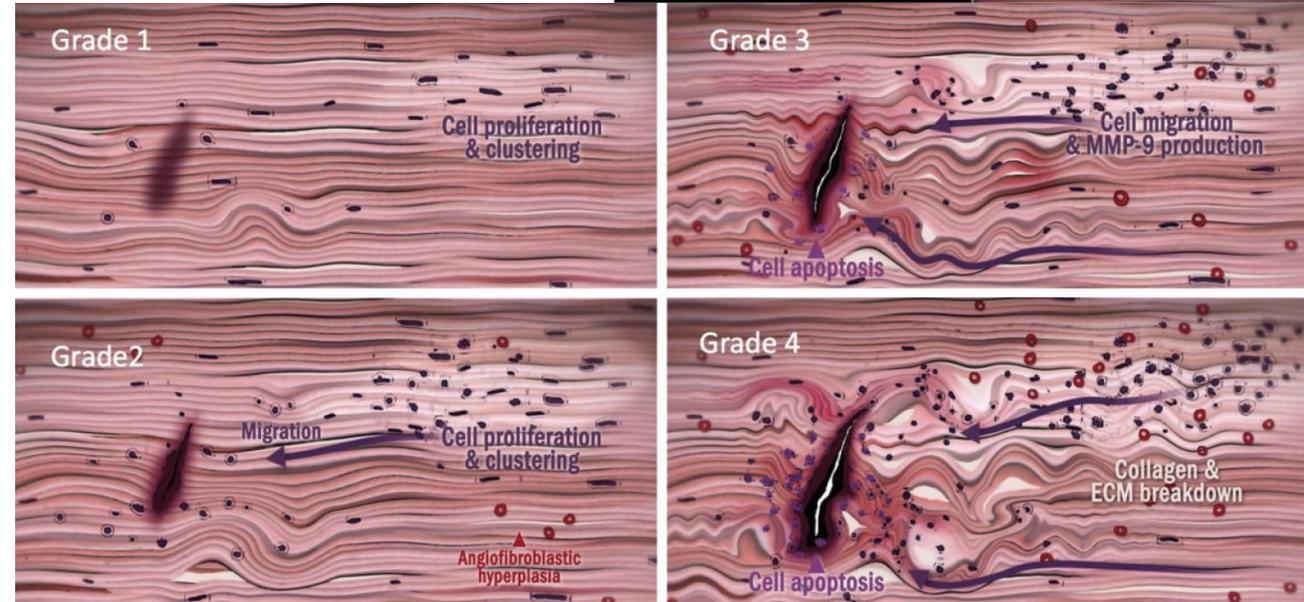
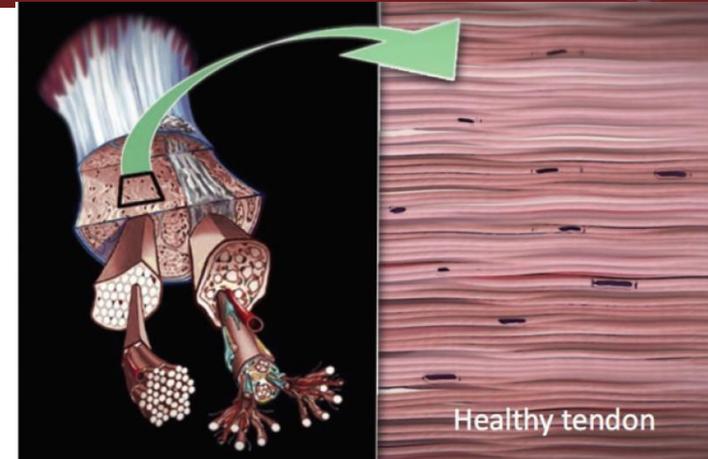
In **healthy tendon**, type 1 collagen fibers are organized and layered side-to-side and end-to-end, essentially parallel but with a very slight wave pattern. The tenocytes are elongated and uniform in number.

In **grade 1** tendinopathy, the tight array of collagen fibers loosens with increasing waviness. There is a relative increase in type 3 collagen and minimal cell proliferation.

In **grade 2** tendinopathy, there is increasing cell proliferation and clustering as well as angiogenesis. The nuclei of the cells become rounded, and the collagen fibers are further disrupted and start to fragment.

In **grade 3**, tendinopathy there is cell death by apoptosis. There is increased cell migration and matrix metalloproteinase (MMP) production. The extracellular matrix begins to breakdown until, in

In **grade 4** tendinopathy, there is structural and mechanical failure.



SYSTEMIC REVIEW

Clinics in Shoulder and Elbow Vol. 22, No. 4, December, 2019  
<https://doi.org/10.5397/cise.2019.22.4.227>



## Current Trends for Treating Lateral Epicondylitis

Gyeong Min Kim, Seung Jin Yoo, Sungwook Choi, Yong-Geun Park<sup>✉</sup>

Department of Orthopedic Surgery, Jeju National University Hospital, Jeju National University School of Medicine, Jeju, Korea

2019

**OPEN** Research Article

## Trends in Corticosteroid Injections for Treatment of Lateral Epicondylitis: An Analysis of 80,169 Patients

John Q. Sun, BS   
 Quinn A. Stillson, BS   
 Jason A. Strelzow, MD   
 Lewis L. Shi, MD 

**Table 1. Treatment Modalities for Lateral Epicondylitis**

Modality	N (%)
Corticosteroid injection	16,479 (20.6)
Physical therapy	12,180 (15.2)
Bracing treatment	1,874 (2.3)
Surgery	2452 (3.1)
Total patients	80,169

2021

### Conservative/non operative:

- Rest
- Cryotherapy
- Brace
- NSAIDs
- Physiotherapy
- Injection therapy (corticosteroids, botulinum toxin and PrP/growth factors)
- Ultrasound therapy
- **Extracorporeal shock wave therapy (ECSW)**

### Invasive:

- ECRB release
- Resection of the tendinosis portion of the affected tendon via different approaches (arthroscopic/open)

## Shockwave therapy vs CCS injections

Shock-wave therapy versus corticosteroid injection on lateral epicondylitis: a meta-analysis of randomized controlled trials

2019

Yuan Xiong, Hang Xue, Wu Zhou, Yun Sun, Yi Liu, Qipeng Wu, Jing Liu, Liangcong Hu, Adriana C. Panayi, Lang Chen, Chenchen Yan, Bobin Mi & Guohui Liu

**Both SW and CS** in relieving pain and improving self-reported function in the treatment of LE.

**When follow-up is longer than 12 weeks, better improvement** in the terms of VAS and grip strength can be found in **SW group**, and we assume SW can be a better alternative for the management of LE

## Shock-wave therapy vs Ultrasonics

Yan et al. *Journal of Orthopaedic Surgery and Research* (2019) 14:248  
<https://doi.org/10.1186/s13018-019-1290-y>

Journal of Orthopaedic  
Surgery and Research

SYSTEMATIC REVIEW

Open Access

2019

A comparative study of the efficacy of ultrasonics and extracorporeal shock wave in the treatment of tennis elbow: a meta-analysis of randomized controlled trials



Chenchen Yan<sup>1</sup>, Yuan Xiong<sup>1</sup>, Lang Chen<sup>1</sup>, Yori Endo<sup>2</sup>, Liangcong Hu<sup>1</sup>, Mengfei Liu<sup>1</sup>, Jing Liu<sup>1</sup>, Hang Xue<sup>1</sup>, Abudula Abududilibaier<sup>1</sup>, Bobin Mi<sup>1\*</sup> and Guohui Liu<sup>1\*</sup>

- No significant difference in the elbow function evaluation scores between ESWT and US,
- The superiority of the ESWT group in the **VAS of pain** (both at 1 month, 3months, and 6 months follow-ups) raised **grip strength** in ESWT group
- **ESWT offers more effective therapy** for lateral epicondylitis than US therapy.

## Shockwave therapy vs Laser therapy



ACTA ORTHOPAEDICA et TRAUMATOLOGICA TURCICA

[www.aott.org.tr](http://www.aott.org.tr)

Research Article

2020

### Comparison of low level laser therapy and extracorporeal shock wave in treatment of chronic lateral epicondylitis

Türkan Turgay<sup>1,2</sup> , Pınar Günel Karadeniz<sup>3</sup> , Gökhan Bülent Sever<sup>4</sup> 

- Evidence from this study revealed that although **both treatment modalities** were **effective** in the treatment of CLE
- ESWT seemed to **more effective** in **pain relief and functional recovery** than LLLT.

## METHODS

### INCLUSION CRITERIA:

- Acute/chronic pain
- Tenderness at the medial/lateral epicondyle
- + specific tests
- Absence of specific contraindications for ESWT
- Not responsive to previous rehabilitation treatments

### EXCLUSION CRITERIA:

- Inflammatory arthropathy
- Pregnancy
- Age < to 18 years
- Arthrosis
- Infections
- Neoplastic pathologies
- Coagulopathies/treatment with antiplatelet agents
- Microinstability
- Loose bodies
- PIN/ulnar entrapment
- Synovial plica
- Panner's disease

## METHODS



- Submission of specific questionnaires:

**DASH score**

**Mayo Elbow Performance Score**

- Evaluation of the VAS scale and of the range of motion
- Clinical evaluation through specific tests for epitrocleitis and epicondylitis

- Before starting treatment (T0)
- At follow-up (2, 6 and 12 months)

## Mayo Elbow Performance Score (1993):

- Pain (45 pts)
- Range of motion (20 pts)
- Stability (10 pts)
- Daily function (25 pts)

Score range	Condition
Score 10-45	Good
Score 45-70	Fair
Score 70-75	Poor



Higher the score → better conditions

## DASH score (1996):

- 38 questions divided in 3 sessions:
  1. Activities of daily living
  2. Work-related activities
  3. Sport-related activities



Higher the scores → worst conditions

## SPECIFIC CLINICAL TESTS



### COZEN's Test

Radial deviation; elbow flexed  
A-R wrist extension



### MAUDSLEY's Test

A-R Long finger extension



### MILL's Test

Passive wrist flexion from flexed to  
extended elbow

## Therapeutic protocol

- N° of sessions: variable (minimum 6 sessions, once a week) and repeatable in the following months
- N° pulses: 3000 pulses per session
- Frequency: 5 Hz
- Duration of each session: 11 minuti
- Energy level: variable (to patient tolerance), 11 to 20 millijoules

## RESULTS

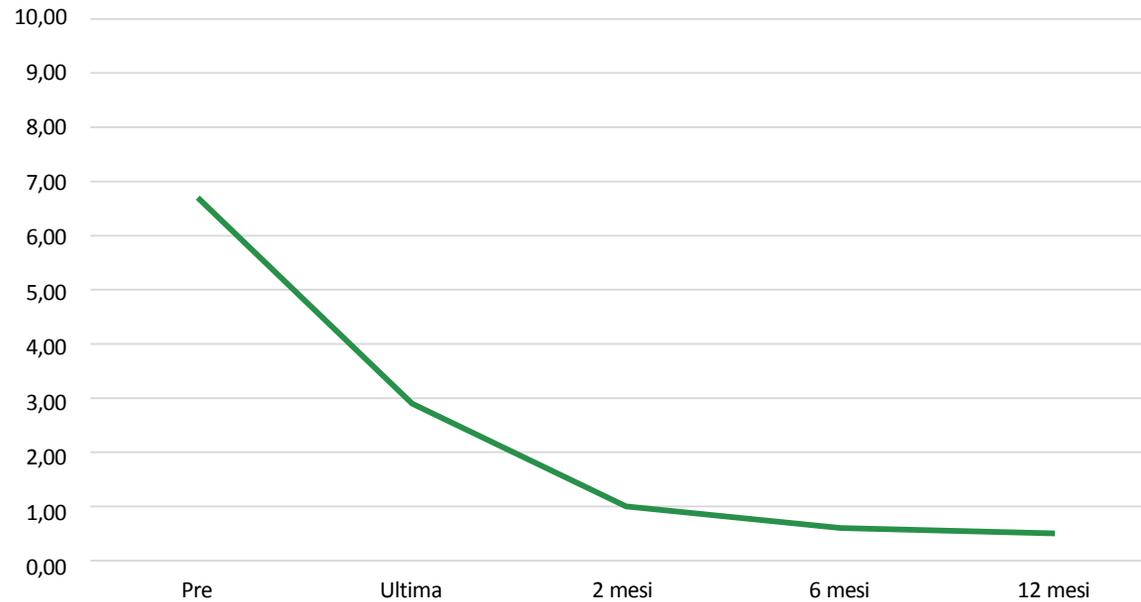
### 70 patients:

- **Mean age** 50 years old (range 20 – 67 years)
- 44 males e 26 females → **M:F = 1.7**
- **Affected side:**
  - Right 77%
  - Left 20%
  - Bilateral 3%
- **27% previous** history of epicondylitis/epitrocleitis → 1 case of recurrence after open surgical treatment
- **Level of sport activity:**
  - 28.5% sedentary
  - 25.7% low level
  - **32.8% mid-level**
  - **12.8% high level**
- 38% performed pre, but not post, instrumental examinations

## RESULTS - VAS



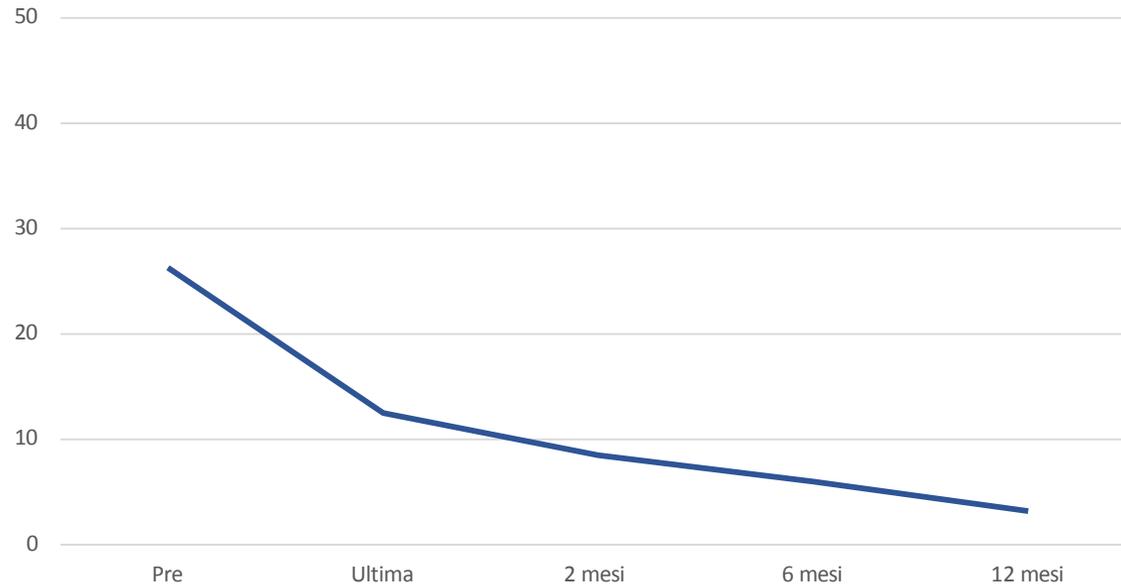
Mean VAS



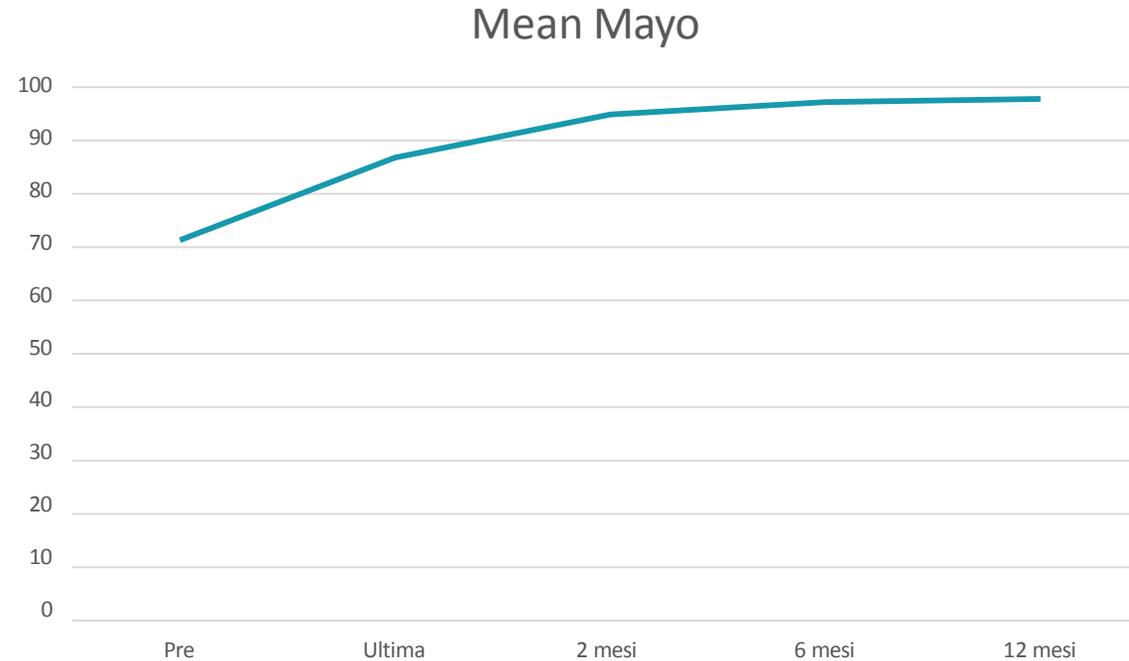
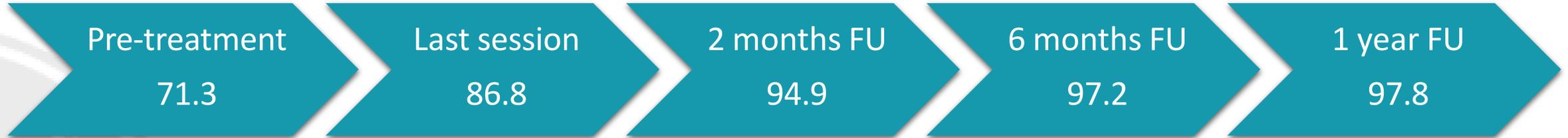
## RESULTS - DASH Score



Mean DASH



## RESULTS - Mayo Score





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# FOCAL SHOCKWAVES : A MULTICENTRIC STUDY.

Lessons learned at the  
Italian Congress for the  
Study of Focused Shock Waves

(FST)  
*Saturday 1st July 2023*

# «Focal shock waves in musculoskeletal pathology: non-union and pseudarthrosis.»»

U. Tarantino – MD, PHD

S. M. Tecce MD

A. Di Giorno MD

*Policlinico Universitario Roma 2*

*Tor-Vergata Director Prof. U. Tarantino*



# Indication

- CONSOLIDATION DELAYS
- PSEUDOARTHROSIS
- STRESS FRACTURES
- ASEPTIC NECROSIS/ OSTEOCHONDRITIS



## B. INDICAZIONI

### 1. Indicazioni approvate come "standard"

#### 1.1 Tendinopatie croniche

- 1.1.1. Tendinopatia calcifica di spalla
- 1.1.2. Epicondilopatia laterale del gomito (epicondilite, o gomito del tennista)
- 1.1.3. Sindrome del grande trocantere
- 1.1.4. Tendinopatia rotulea
- 1.1.5. Tendinopatia Achillea
- 1.1.6. Fascite plantare (con o senza sperone calcaneare)

#### 1.2. Patologie dell'osso

- 1.2.1. Ritardi di consolidazione
- 1.2.2. Pseudoartrosi
- 1.2.3. Fratture da stress
- 1.2.4. Necrosi asettica senza degenerazione articolare
- 1.2.5. Osteocondrite dissecante (OCD) senza degenerazione articolare

#### 1.3. Patologie cutanee

- 1.3.1. Ferite "difficili"
- 1.3.2. Ulcere diabetiche
- 1.3.3. Ulcere distrofiche
- 1.3.4. Ustioni non circonferenziali

# What is our experience?



Review > Foot (Edinb). 2022 May;51:101889. doi: 10.1016/j.foot.2021.101889. Epub 2021 Dec 10.

**Extracorporeal shock wave treatment of ankle fracture non-unions - A review**  
Iris H Y Kwok <sup>1</sup>, Edmund Ieong <sup>2</sup>, Mosaab A Aljalalham <sup>3</sup>

> Eur J Trauma Emerg Surg. 2022 Aug;48(4):3043-3049. doi: 10.1007/s00068-021-01782-1. Epub 2021 Sep 13.

**High-energy extracorporeal shockwave therapy in the treatment of humeral delayed and non-unions**  
Falko Dahm <sup>1 2</sup>, Xaver Feichtinger <sup>3 4</sup>, Sascha-Mario Vallant <sup>3</sup>, Nicolas Wolfgang Schaden <sup>3 4 6</sup>, Christian Fialka <sup>3 7</sup>, Rainer Mittermayr <sup>3 4 6</sup>

> J Biol Regul Homeost Agents. 2020 Nov-Dec;34(6):2325-2330. doi: 10.23812/20-206-L.

**Clinical experience of extracorporeal shockwave treatment on diaphyseal forearm non-union on healing and bone density**  
A Notarnicola <sup>1 2</sup>, M Baglioni <sup>1</sup>, I Covelli <sup>1 2</sup>, F P Bianchi <sup>3</sup>, L Moretti <sup>1</sup>, G B Moretti <sup>1 2</sup>

> Injury. 2016 Jul;47(7):1506-13. doi: 10.1016/j.injury.2016.04.010. Epub 2016 Apr 20.

**Extracorporeal shockwave therapy (ESWT) ameliorates healing of tibial fracture non-union unresponsive to conventional therapy**  
Nicolas Haffner <sup>1</sup>, Vlado Antonic <sup>2</sup>, Daniel Smolen <sup>3</sup>, Paul Slezak <sup>3</sup>, Wolfgang Schaden <sup>4</sup>, Rainer Mittermayr <sup>5</sup>, Alexander Stojadinovic <sup>6</sup>

# Our case history

Data collected at the CKF Di Giorno centers between 2021 and 2023

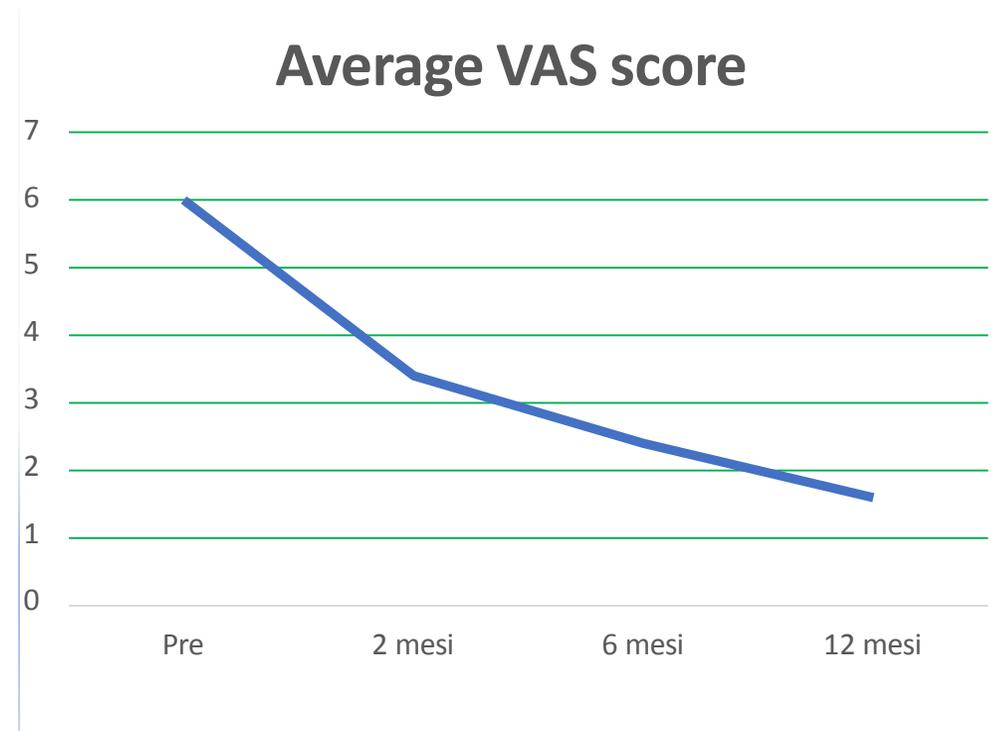
M/F	Average age	smokers/ non smokers	Open fracture	Infection
2/1	39,7	2/5	1/15	1/5

Average number of sessions	VAS 1st session	VAS after 2 months	VAS after 6 months	VAS after 12 months
8	6	3,4	2,5	1,6

93.3% of patients had an improvement in pain symptoms.

# Our case history

*Data collected at the CKF Di Giorno centers between 2021 and 2023*



93.3% of patients had an improvement in pain symptoms.

# Our case history

Data collected at the CKF Di Giorno centers between 2021 and 2023

### Non-union scoring system (Calori et al. Injury 2008):

- Non-union personality: Bone, soft tissue, patient (infection, smoking).
- 15 parameters: score from 0-100

The bone		Score	Max. score
Bone quality	Good	0	3
	Moderate	1	
	Poor	2	
	Very poor	3	
Primary injury – open or closed fracture	Closed	0	5
	Open grade I	1	
	Open grade II – IIIA	3	
	Open grade IIIB and IIIC	5	
Number of previous interventions on the bone to procure healing	None	1	4
	<2	2	
	2-4	3	
	>4	4	
Invasiveness of previous interventions	Minimally invasive – closed surgery	0	3
	Internal intra-medullary nailing	1	
	Internal extra-medullary	2	
	Any osteosynthesis which include bone grafting	3	
Adequacy of primary surgery	Inadequate stability	0	1
	Adequate stability	1	
Weber & Cech group	Hypertrophic	1	5
	Oligotrophic	3	
	Atrophic	5	
Bone alignment	Non-anatomical alignment	0	1
	Anatomical alignment	1	
Bone defect – gap	0.5-1 cm	2	5
	1-3 cm	3	
	>3 cm	5	

### Non-union scoring system: Calori et al. Injury 2008

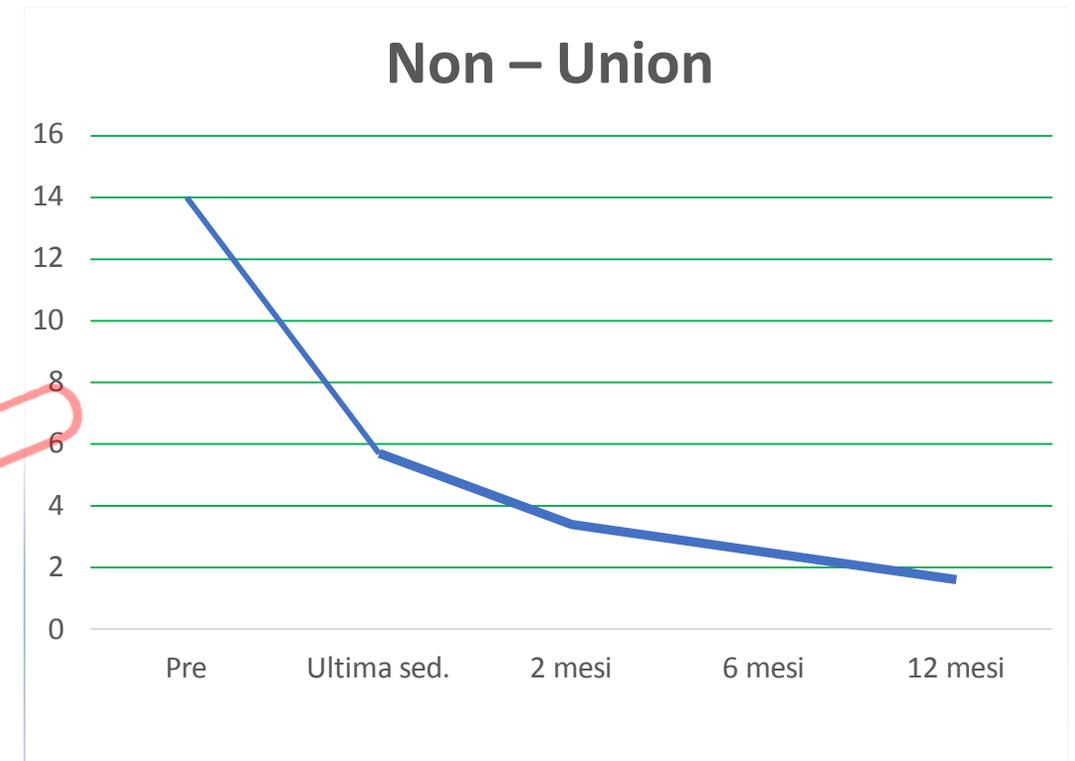
Soft tissues		Score	Max. score
Soft tissue status	Intact	0	6
	Minor scarring	2	
	Previous treatment of soft tissue defect	3	
	Previous free flap	4	
	Poor vascularity	5	
	Presence of skin lesion / defect	6	
The patient		Score	Max. score
ASA grade	1 or 2	0	1
	3 or 4	1	
Diabetes	No	0	2
	Yes – well controlled	1	
	Yes – poorly controlled	2	
Blood tests: FBC, ESR, CRP	FBC: WCC > 12	1	3
	ESR > 20	1	
	CRP > 20	1	
Clinical infection status	Clean	0	4
	Previously infected or suspicion of infection	1	
	Septic	4	
Drugs	Steroids	1	2
	NSAIDs	1	
Smoking	No	0	5
	Yes	5	

## Non – Union Scoring System.

# Our case history

*Data collected at the CKF Di Giorno centers between 2021 and 2023*

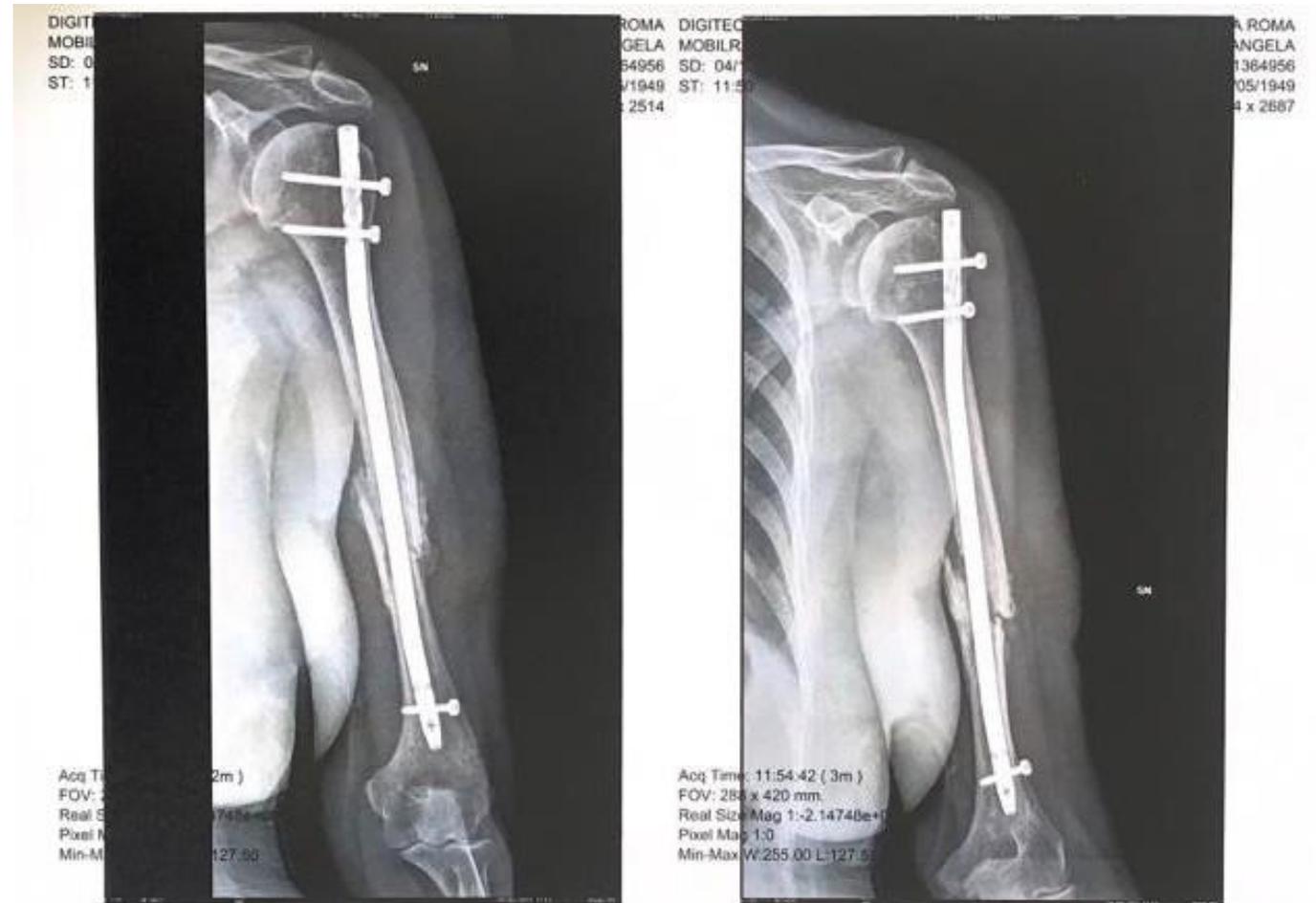
Average Non Union Pre	Average Non Union last session	Average Non Union after 2 months	Average Non Union after 6 months	Average Non Union after 12 months
14	5,7	3,4	2,5	1,6



# Clinical case n° 1

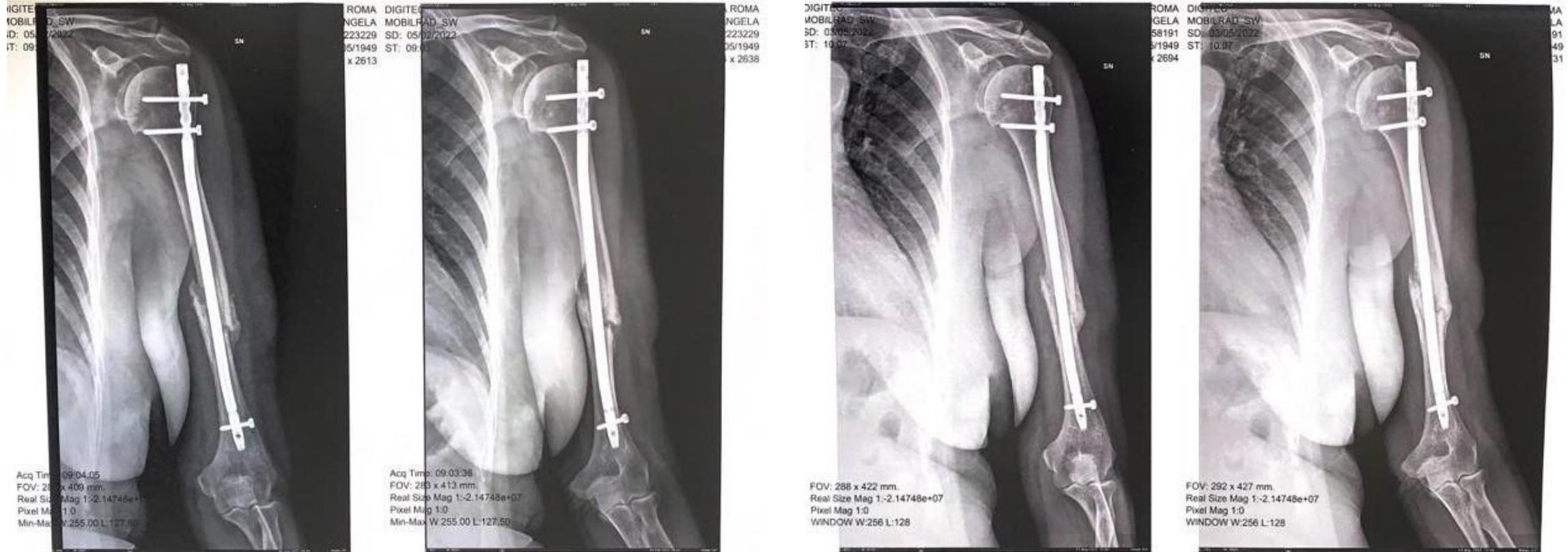
Sex: female  
Age: 73 anni  
Height: 1,65  
Weight: 65  
BMI: 23,88 kg/m<sup>2</sup>

- Well balanced diet
- Non smoker
- Sedentary life (retired)
- Fracture of the humeral shaft
- (fall on the beach)



Right humeral shaft fracture treated with intramedullary nail (2021).

# Clinical case n° 1



Cycle of X shock wave sessions at the CKF center in Rome.

# Clinical case n° 1

## *Clinical trend of pain symptoms (VAS scale)*

<i>VAS 1st session</i>	<i>VAS 5th session</i>	<i>VAS 10th session</i>	<i>VAS after 2 months</i>	<i>VAS after 6 months</i>
<b>8</b>	<b>4</b>	<b>7</b>	<b>3</b>	<b>1</b>

Cycle of X shock wave sessions at the CKF center in Rome.

# Clinical case n° 1



Radiographic control four months after the end of the cycle with Shock Waves.

# Clinical case n° 2

Sex: female  
Age: 33 anni  
Height: 1,65  
Weight: 65  
BMI: 23,88 kg/m<sup>2</sup>

- Well balanced diet
- Occasional alcohol intake
- Smoker patient
- Right tibia diaphysis pseudoarthrosis



# Clinical case n° 2



Cycle of XII Shock Wave Sessions at the CKF center in Rome.



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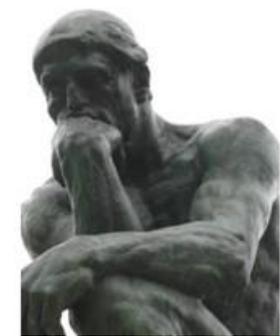
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# FSWT - Greater trochanter pain syndrome



**F. Catani - G. Porcellini**  
**A. Donà - M. Campini**  
**A. Di Giorno**

Policlinico di Modena- UNIMORE  
Direttore Ortopedia e Traumatologia -Prof. Catani  
Direttore Scuola di Specializzazione – Prof. Porcellini

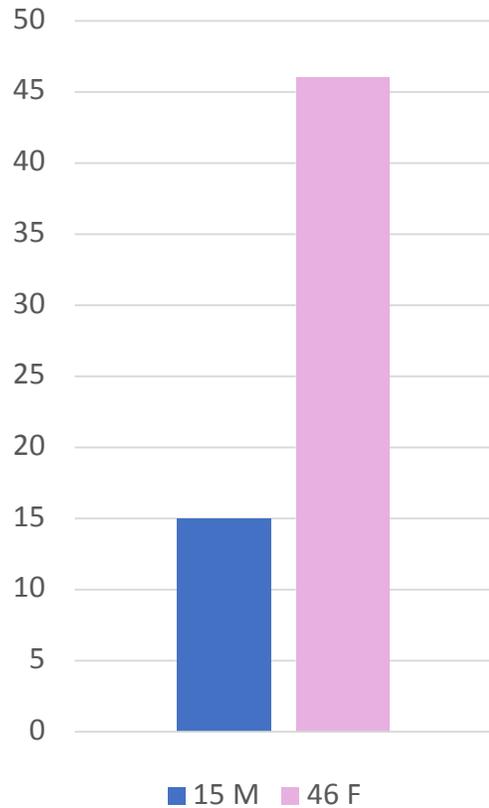
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# Greater trochanter pain syndrome



## 61 patients:

- Age between 41 - 67 yr → Median = 55,5 yr
- BMI between 19 e 36,5:
  - 22 pt with BMI < 25 (Median BMI = 22,3)
  - 39 pt with BMI > 25 (Median BMI = 29,1)
- Physical Activity Levels:
  - 22 pt sedentary (36%)
  - 24 pt gentle (40%)
  - 15 pt moderate (24%)
- Diagnostic investigation: Xr -> US -> MRI
  - 36% calcification

## INCLUSION CRITERIA:

- Atraumatic pain
- Pain on palpation of GT
- Absence of severe coxarthrosis
- Negative Lasegue's sign

## EXCLUSION CRITERIA:

- Specific controindications of FSWT
  - Pregnancy
  - Inflammatory arthropaty
  - Infections
  - Neoplastic diseases
  - Coagulopathy or anticoagulant therapy
- Severe coxarthrosis
- Vertebral, hip or pelvis fractures

# PROTOCOL TREATMENT



- **N° of sessions:** 6 sessions, 1/week
- **N° impulses:** 3000/session
- **Energy power:** 0,20 millijoule
- **Frequency:** 6 Hz
- **Pressure Exerted:** operator dependet
- **Manipulus angolation :** operator dependet
- **Manipulus movement:** operator dependet
- **Local anesthesia:** no



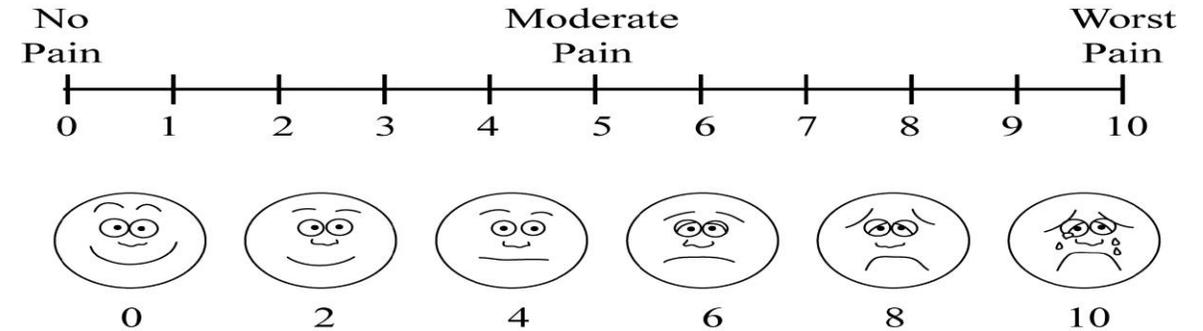
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# EVALUATION SCALES



- **Visual Analogue Scale (VAS)**
- **Roles and Maudsley score:**



Excellent	No pain, full movement, full activity
Good	Occasional discomfort, full movement, full activity
Acceptable	Some discomfort after prolonged activities
Poor	Pain limiting activity

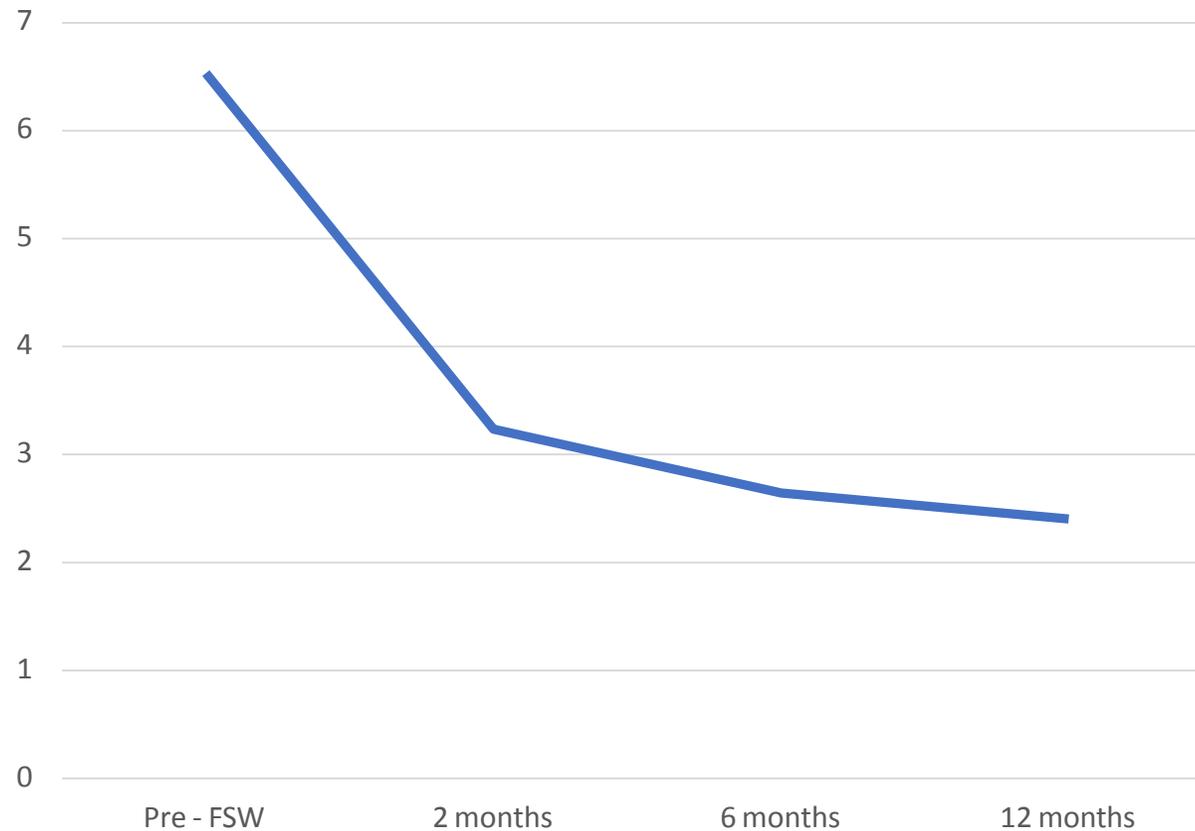
- **Harris Hip score (HHS)**
  - **PAIN**
  - **ACTIVITIES OF DAYLY LIVING**
  - **ROM**



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## MEDIAN VAS score



Median VAS pre FSW  
(6,53)



Median VAS 2 months  
(3,20)

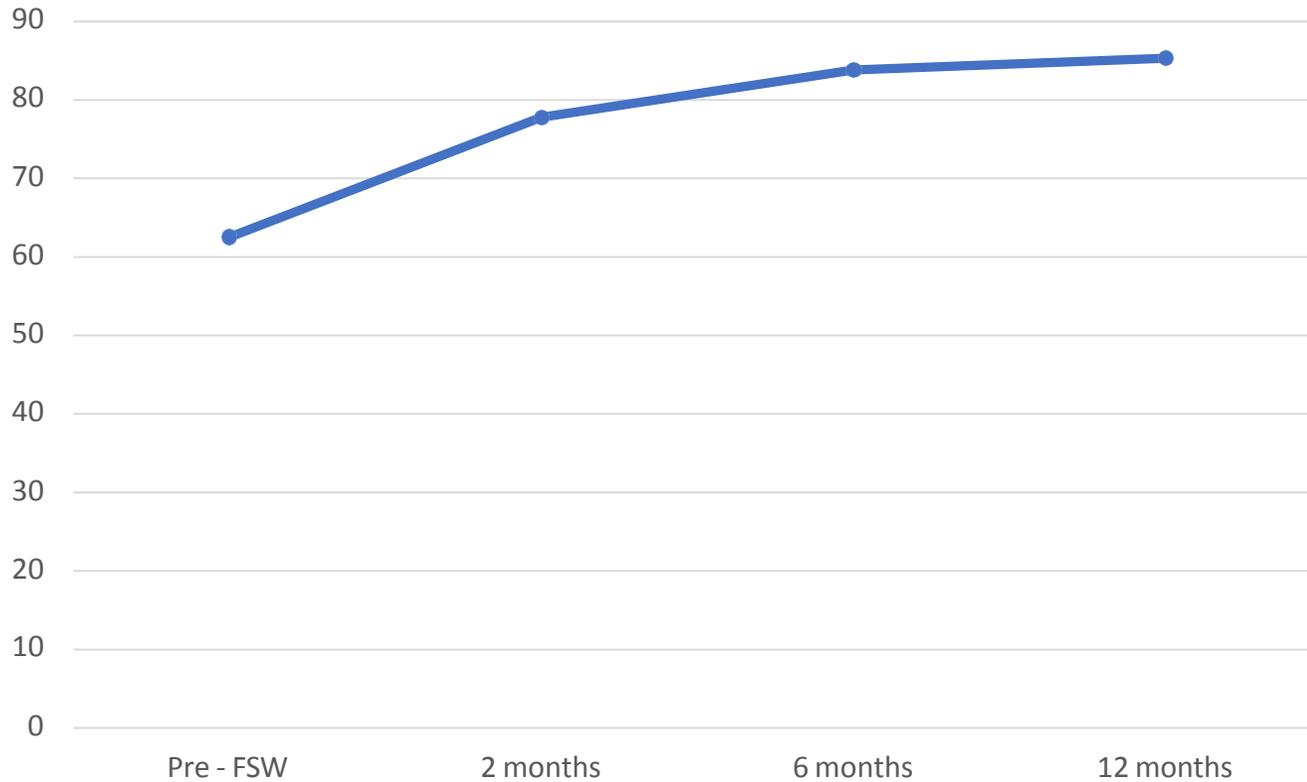


Median VAS a 6 months  
(2,81)



Median VAS a 12 months  
(2,67)

## MEDIAN HHS score



Median HHS pre – FSW  
(62,5)



Median HHS a 2 months  
(77,8)

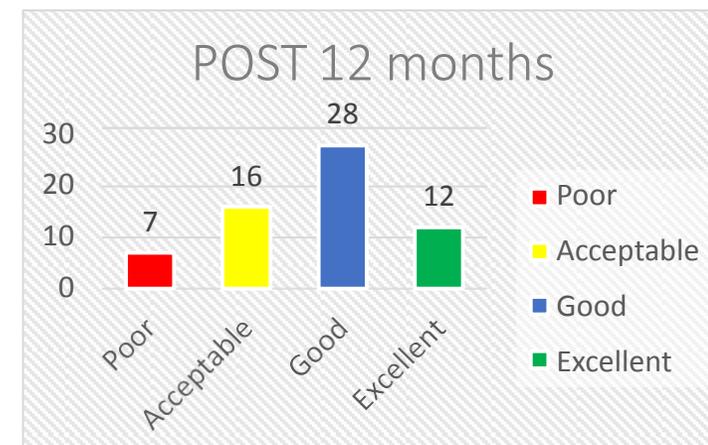
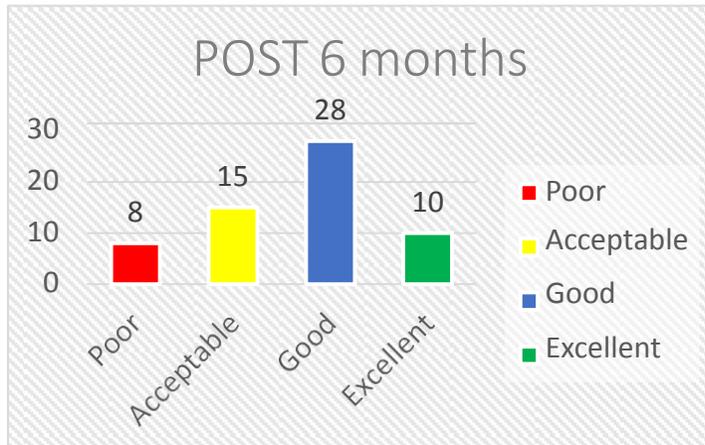
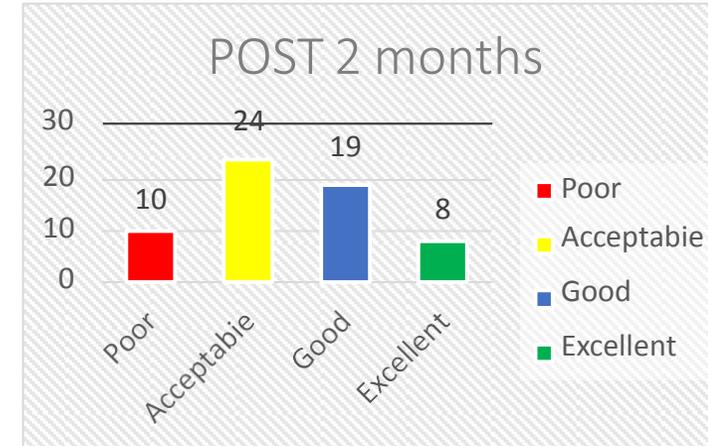
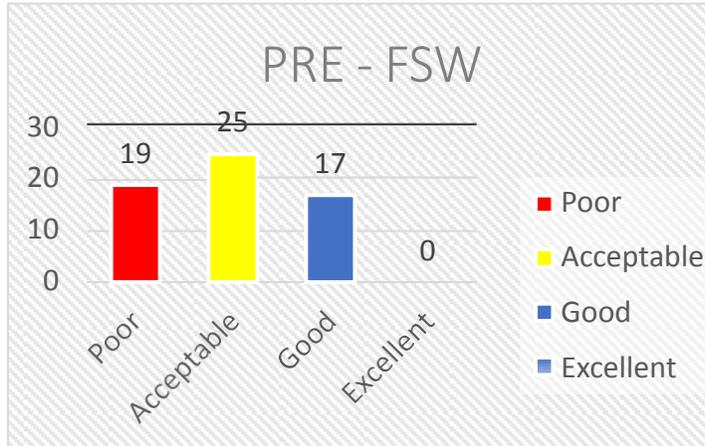


Median HHS a 6 months  
(83,8)



Median HHS a 12 months  
(85,6)

# ROLES AND MAUDSLEY SCORE



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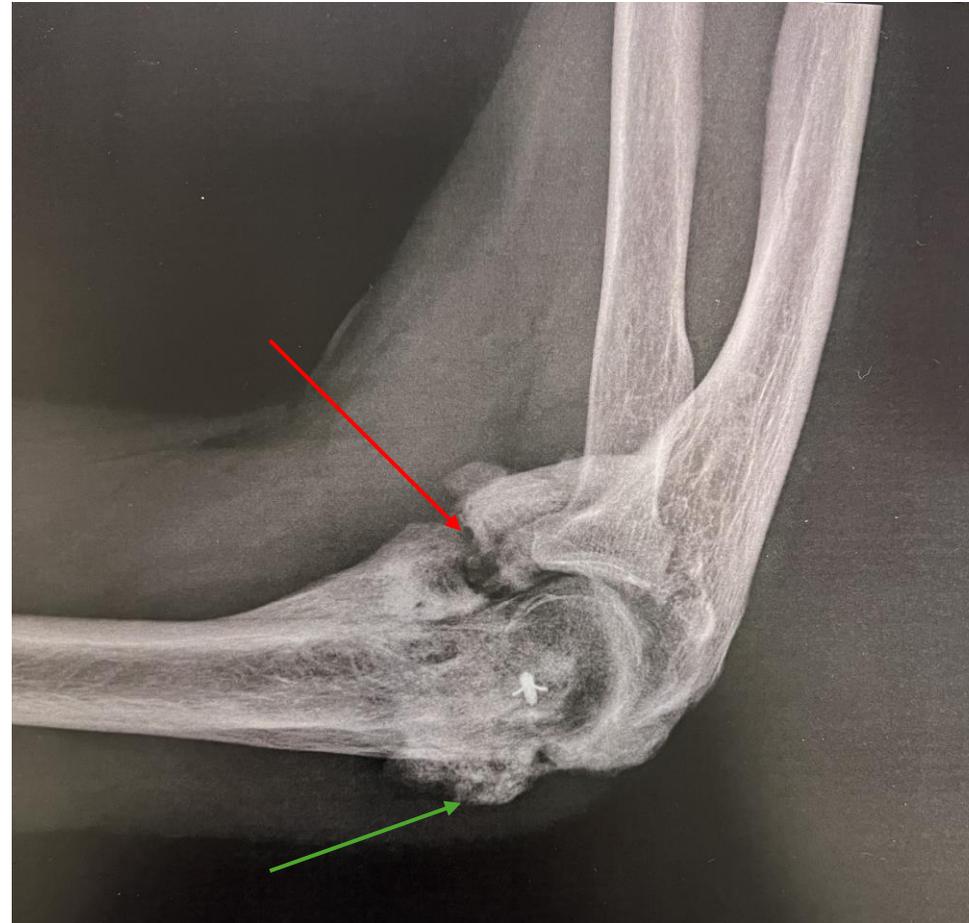
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# Clinical case 1

Sex: Male  
Age: 45  
Diagnosis: joint  
block with many  
calcification.  
Already  
undergone 4  
surgeries.



Cycle of IV shock wave sessions at the CKF center in Rome.

# Clinical case 1

Sex: Male  
Age: 45  
Diagnosis: joint  
block with many  
calcification.  
Already  
undergone 4  
surgeries.



**Radiographic control 1 month after the end of the cycle with  
Shock Waves**

# Clinical case 2

Sex: Male  
Age: 84  
Diagnosis: non  
union  
pertrocanteric  
fracture



**Pertrochanteric  
fracture at trauma  
3 Oct 2023**

# Clinical case 2

Sex: Male  
Age: 84  
Diagnosis: non  
union  
pertrochanteric  
fracture



Radiographic  
control 1 month  
after surgery  
7 nov 2023

# Clinical case 2

Sex: Male  
Age: 84  
Diagnosis: non  
union  
pertrocanteric  
fracture



Radiographic control 2 months after surgery

12 Dec 2023

# Clinical case 2

Sex: Male  
Age: 84  
Diagnosis: non  
union  
pertrochanteric  
fracture



Radiographic control after XV shock waves and after  
the rupture of the screws  
29 Jul 2024

**PARTICIPAÇÃO**

**DR. ALFONSO DI GIORNO**

PRESIDENT OF INTERNATIONAL  
FEDERATION OF SHOCK WAVE  
TREATMENT.



**13 E 14 DE  
NOVEMBRO**

RIO DE JANEIRO/RJ



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DE CHOQUE**

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# THANK YOU ALL !



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