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Expert in minimally invasive intervention pain management (USA,Germany,Taiwan,India)

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Member American College of Rheumatology (ACR)

Member American College of Sports Medicine(ACSM)

Member American Academy of Regenerative Medicine(AARM)

Member Spine Intervention Society(SIS)

**Secretary, International Affairs**

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Faculty, World Federation of Ultrasonography and Medical Biology, (WFUMB) 2017

Faculty, Bangladesh Society of Ultrasound (BSU) and many national conferences.

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# Today's Talk

- **Bonemarrow aspirate concentrate (BMAC) mesenchymal stem cells (BM-MSCs) in Osteoarthritis knee - Case series.**



# Next 7 min

- Background
- Case Series
- Result
- Discussion
- Clinical trial
- Conclusion



# Background

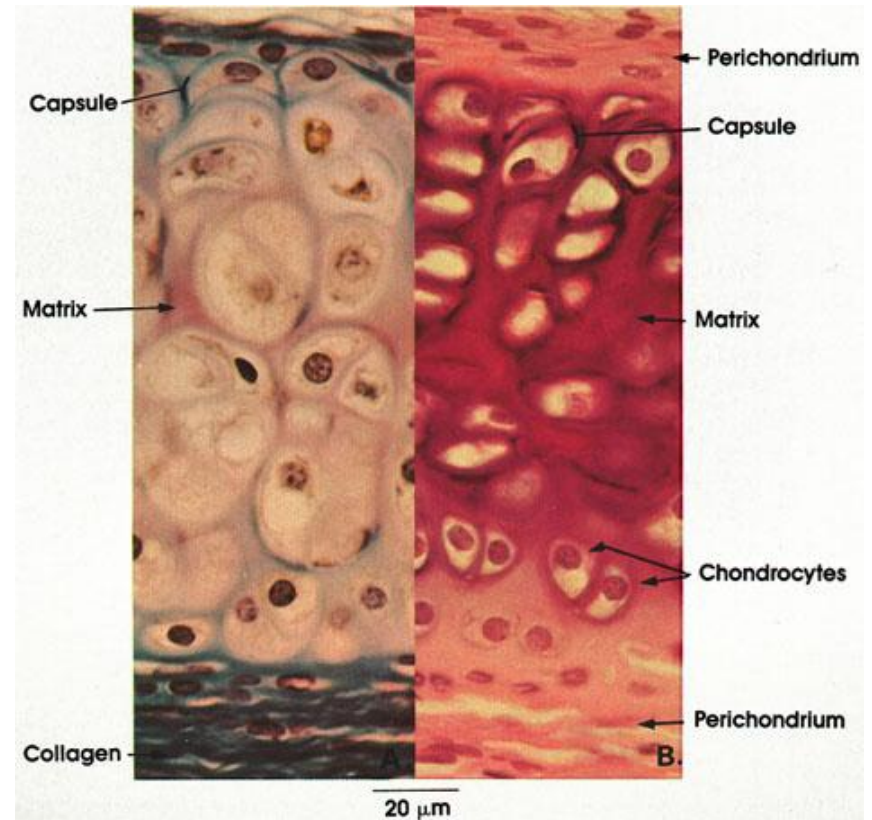
- The capacity of articular cartilage is limited to heal due to low mitotic potential of chondrocyte in vivo. Thus defects in the Joint cartilage progress to osteoarthritis<sup>1</sup>.

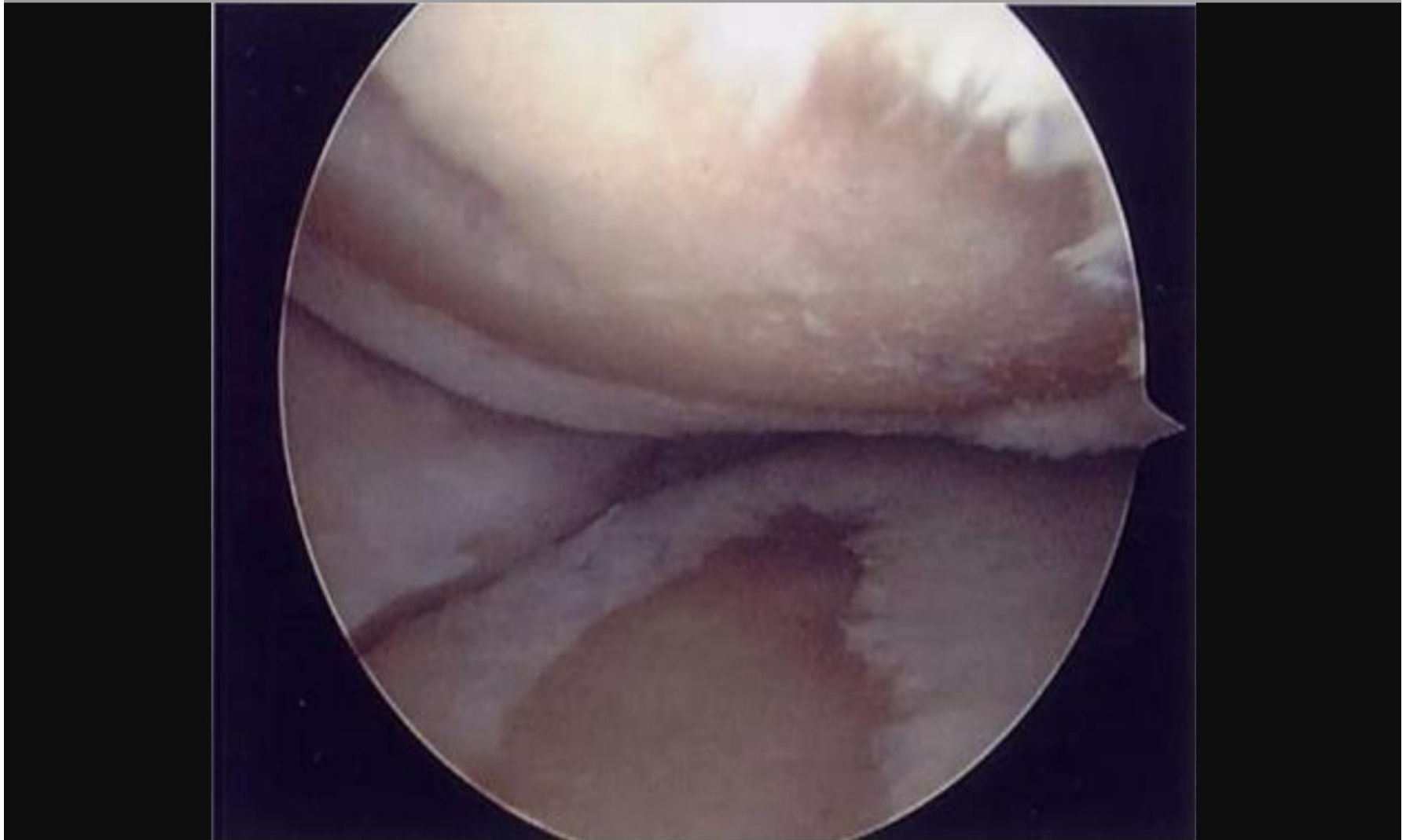
1. Kuroda R, K Ishida, T Matsumoto, T Akisue, H Fujioka, K Mizuno, H Ohgushi, S Wakitani and M Kurosaka. (2007). Treatment of full thickness articular cartilage defect in the femoral condyle of an athlete with an autologous bone marrow stromal cells. *Osteoarthritis Cartilage* 15:226-231.



# Cartilage

- **Cartilage** does not contain blood vessels (it is avascular) or nerves (it is aneural).
- **Nutrition** is supplied to the chondrocytes by diffusion.
- So, poorly adapted to heal & recovery.





# Treating OA

- Non-Pharmacological:





# Drug Therapy





# Intra-articular Injections

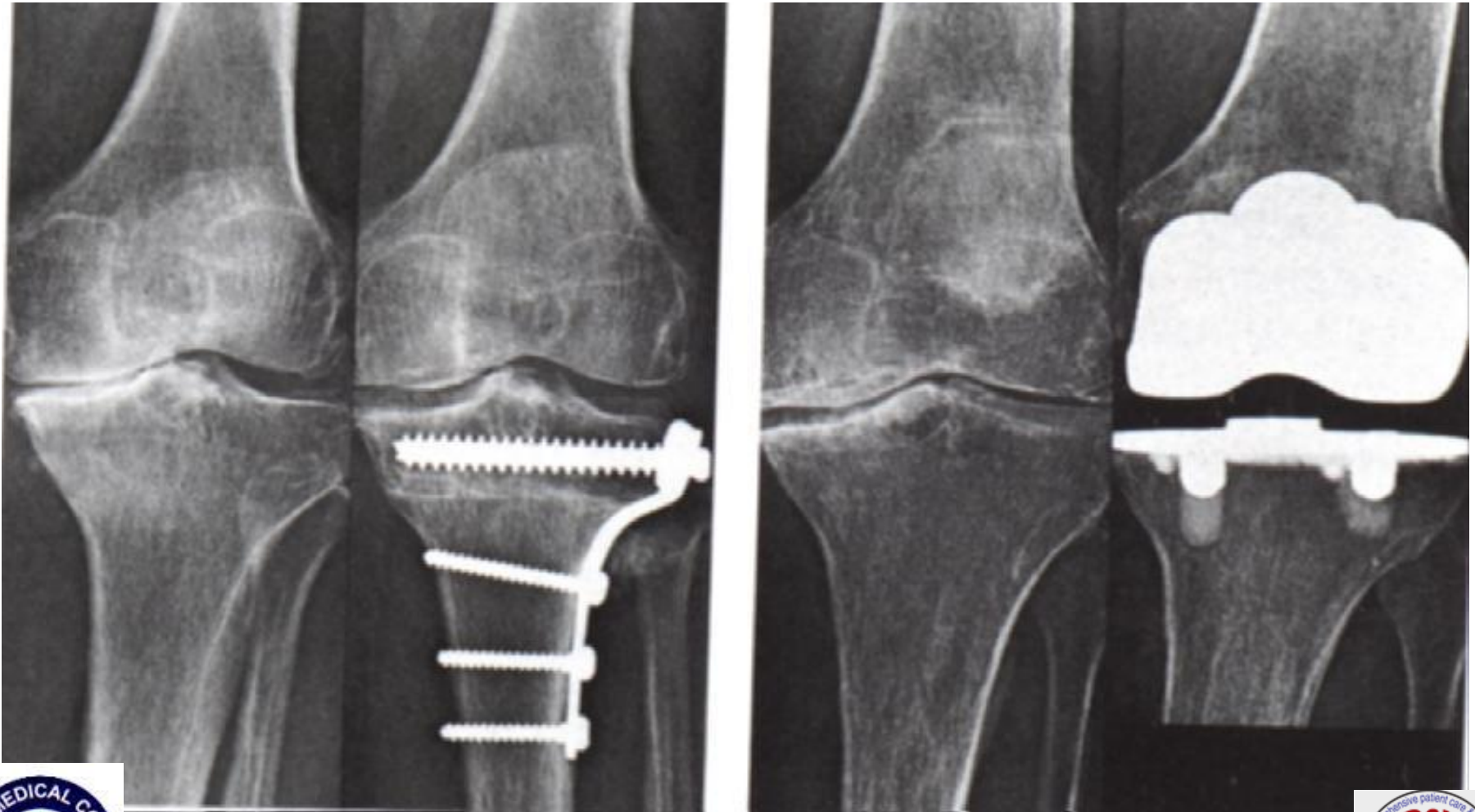
There are two main types of intra-articular injections.



1. Steroids – Injected into the joint to decrease inflammation.
2. Viscosupplementation – Injected into the joint to provide lubrication.



# Ultimately



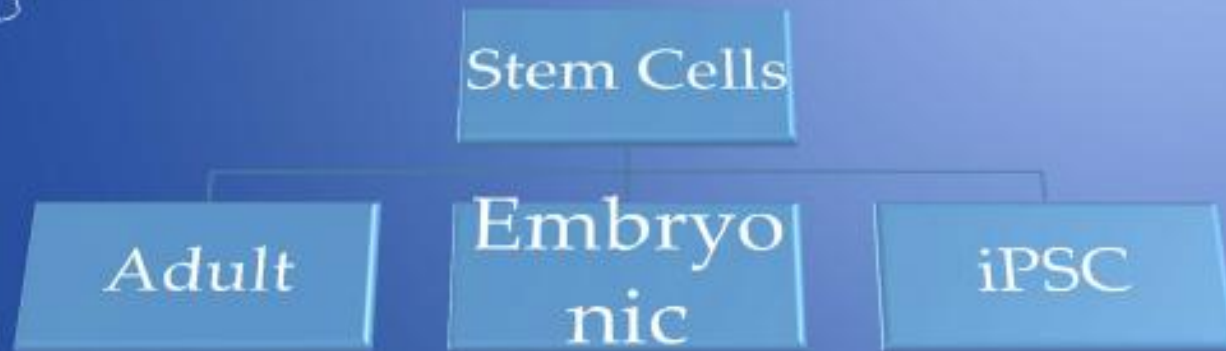
# Risk of knee arthroplasty

- Bleeding-----Blood Bank
- Infection-----Antibiotics
- Damage to nerves, blood vessels, tendons, ligaments
- Failure of Procedure, Fracture, Dislocation (esp. hips)
- BLOOD CLOTS-----Blood Thinner (e.g. Coumadin) for 6 weeks after surgery

- To address these limitations, the use of autologous stem cell was investigated.
- Stem cells are generally defined as undifferentiated cells that are capable of selfrenewal through replication.



# Different STEM CELL TYPE



- MSCs are commonly called adult stem cells which is necessary to maintain tissue and organ mass during cellular turnover.
- Normally remain quiescent (non-dividing) for relatively long periods of time until they are activated by signals to maintain tissues.





- Autologous Bonemarrow Aspirate Concentrate (BMAC) is one of the best sources of MSCs.
- These stem cells are autologous and therefore there is no risk of genetic disease transmission.



- The BMAC-MSCs has the ability to differentiate into chondrocytes, fibroblasts, and other musculo-skeletal tissue and among this, chondrogenic & osteogenic transformation capability is more than lipoaspirate.<sup>2</sup>

2.Noel D, D Caton, S Roche, C Bony, S Lehmann, L Casteilla, C Jorgensen and B Cousin. (2008). Cell specific differences between human adipose-derived and mesenchymal-stromal cells despite similar differential potentials. *Exp Cell Res* 314:1575-1584.





fertilised egg

Generates every cell in the body including the placenta and extra-embryonic tissues

Can form the entire human being



totipotent stem cells



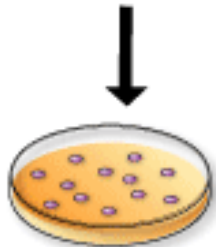
blastocyst containing pluripotent stem cells

Can generate every cell in the body except placenta and extra-embryonic tissues

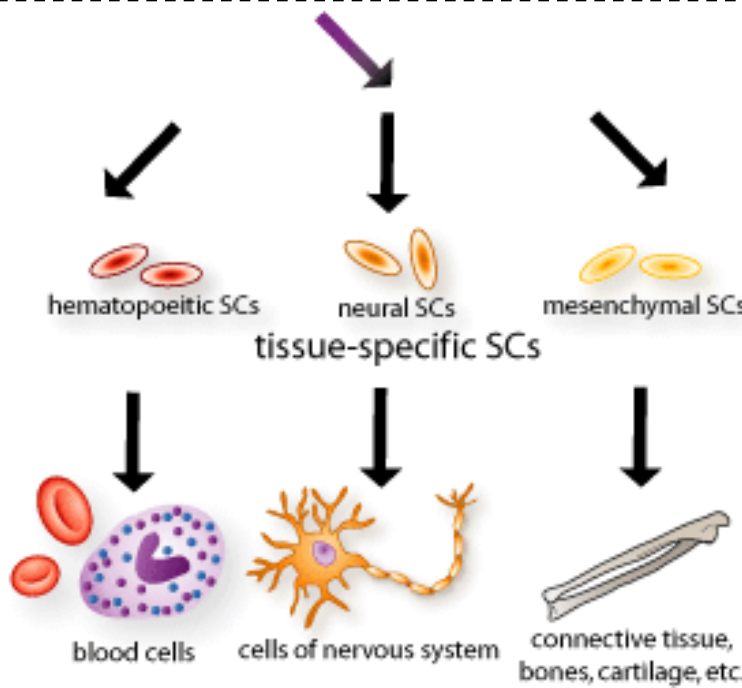
Cannot form the entire human being



isolated pluripotent SCs from inner cell mass



cultured pluripotent SCs



Become specific cell types are less flexible than above

# Study population

- 6



# Study duration

- 7 months (1Jan-31July,2017)



# Study Place



- **drZaman's Interventional Pain, Arthritis, Spine & Stem cell Center**-Popular Medical College Hospital, Dhanmondi, Dhaka.



**drZaman's** FCPS

**Interventional Pain, Arthritis, Spine & Stem Cell Center**

**ADVANCED DIAGNOSIS, ADVANCED TREATMENT**

বাত, ব্যথা, প্যারালাইসিস, স্পাইন এন্ড স্টেম সেল সেন্টার

বয়স এবং ক্ষয় জনিত রোগঃ

পিআরপি এন্ড স্টেম সেল থেরাপি অত্যাধুনিক চিকিৎসা



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# Kellgren and Lawrence system for classification of knee OA

- **grade 0:** No radiographic features of OA are present
- **grade 1:** Doubtful joint space narrowing (JSN) and possible osteophytic lipping
- **grade 2:** Definite osteophytes and possible JSN on anteroposterior weight-bearing radiograph
- **grade 3:** Multiple osteophytes, **definite JSN, sclerosis**, possible bony deformity
- **grade 4:** Large osteophytes, marked JSN, severe sclerosis and **definite bony deformity**

# A 12 months retrospective study of musculoskeletal ultrasound in daily practices in Tertiary Care Hospital of Bangladesh.

Moniruzzaman M<sup>1</sup>, Rahman M<sup>2</sup>, Azad KAK<sup>3</sup>, Rahman HZ<sup>4</sup>, Islam M<sup>5</sup>, Ahmed SM<sup>6</sup>, Saleq AKM<sup>7</sup>, Rahman MH<sup>8</sup>, Khasru MR<sup>9</sup>, Alam MA<sup>10</sup>

**N=1530**

- Normal thickness->0.24cm
- Mild-.20-0.24cm
- Moderate-.10-.19cm
- Severe-<0.10cm
- Knee-24.9%



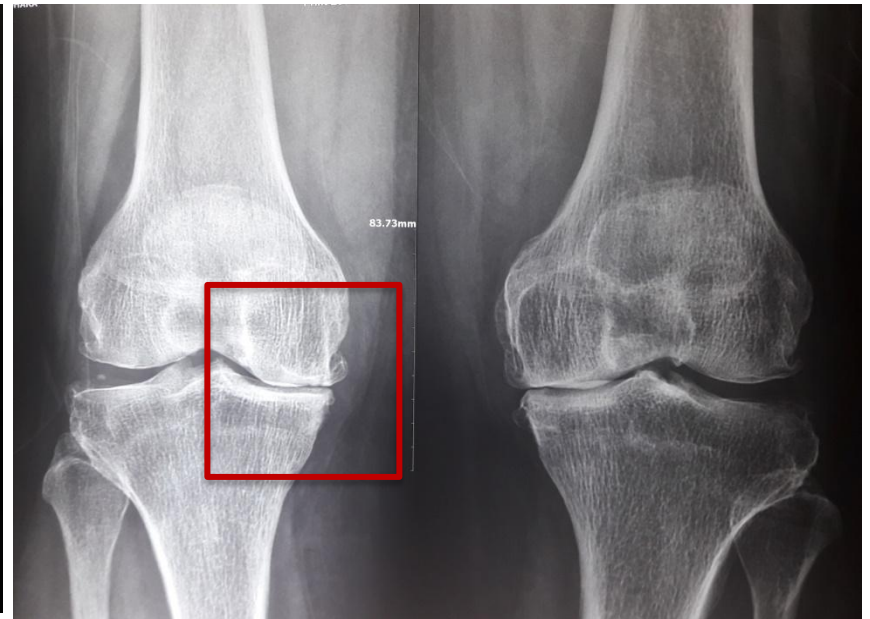
# Case-1



# Bare foot in standing A/P

Before BM-MSCs(4/1/17)

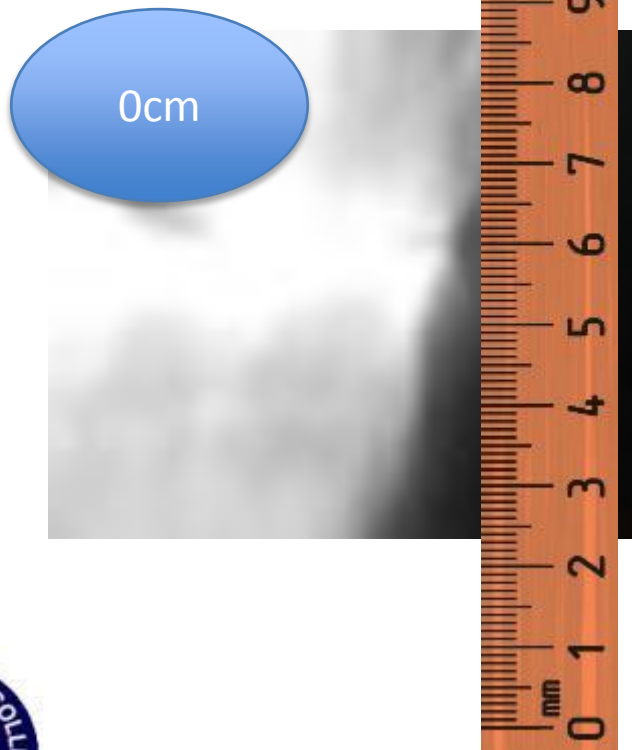
After 6 month of BM-MSCs (8/7/17)



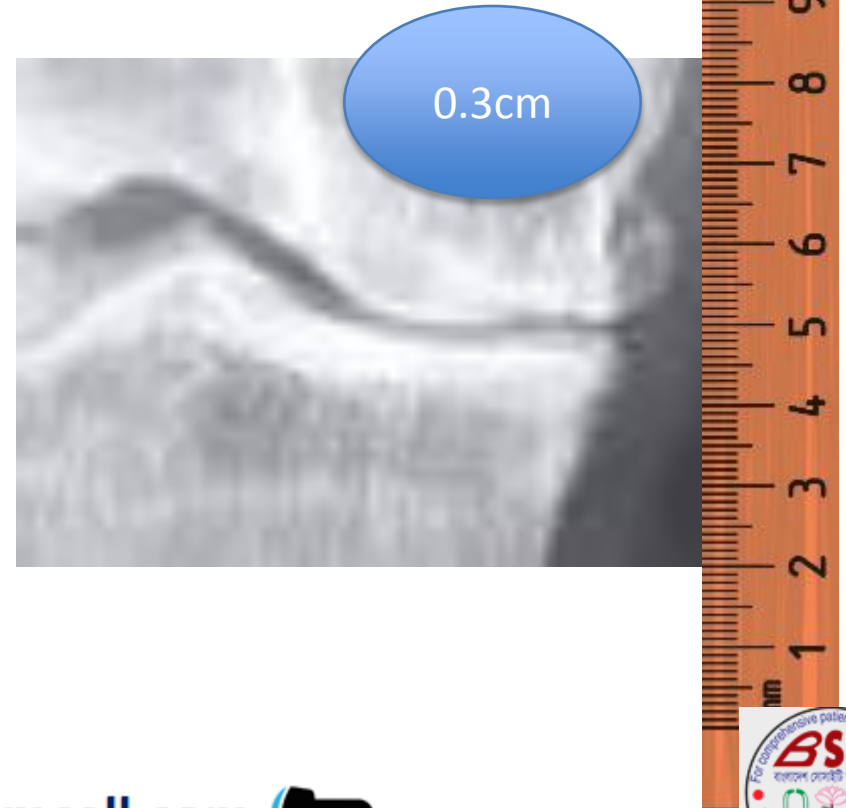


# Right knee

Before treatment



After 6 month

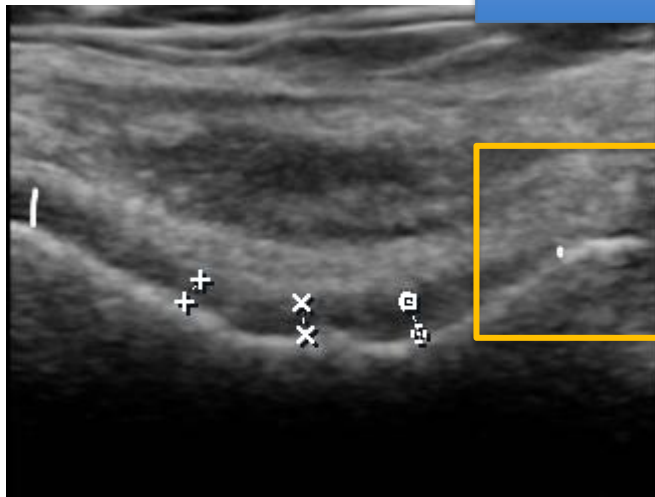




# Right knee

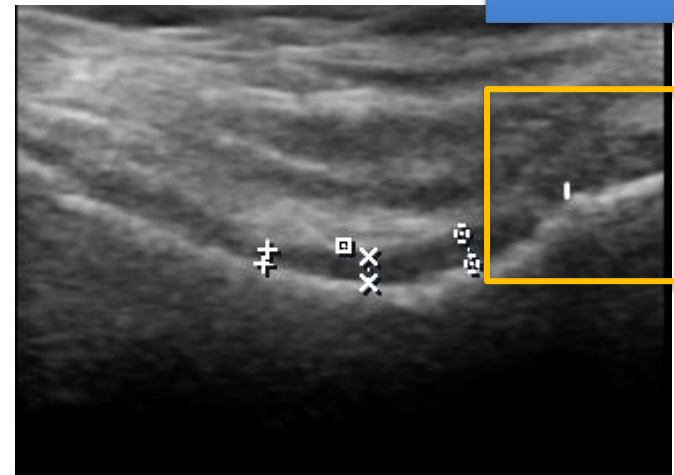
Before 6 month

0.2cm



After 6 month

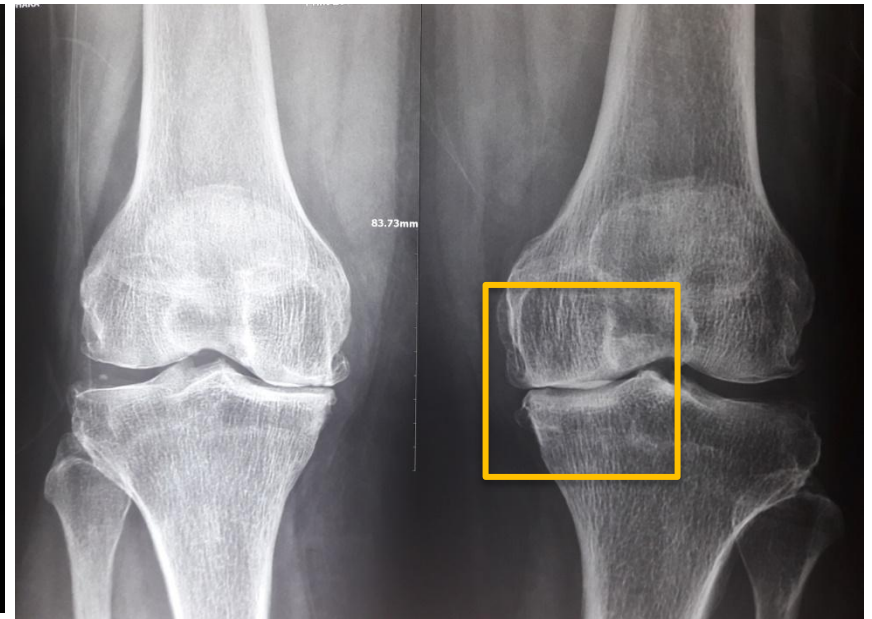
0.7cm



# Bare foot in standing A/P

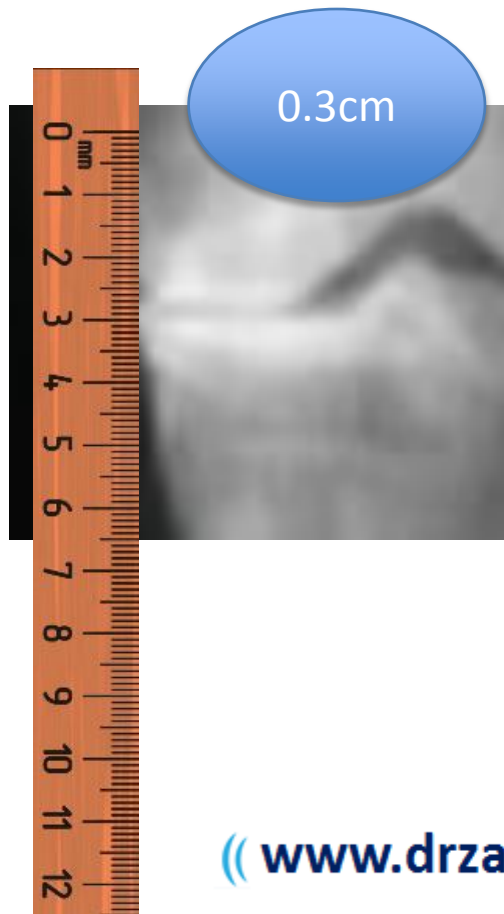
**Before**

**After 6 month**

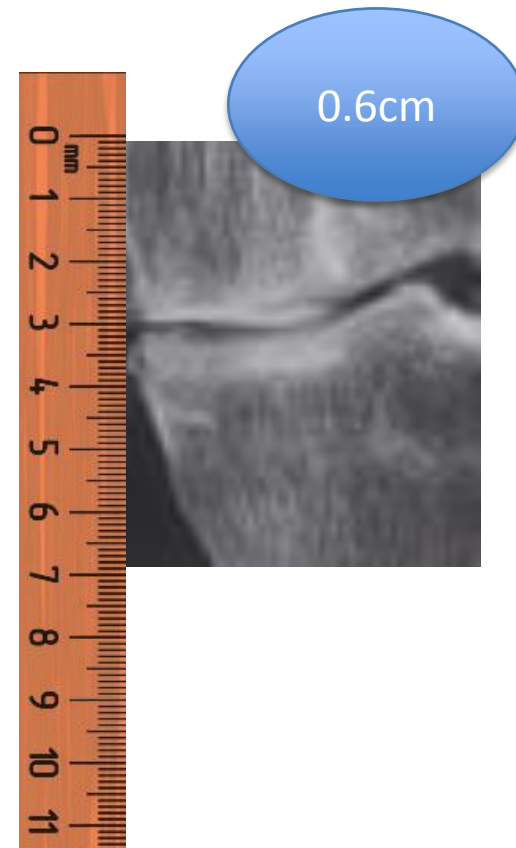


# Left knee

**Before treatment**



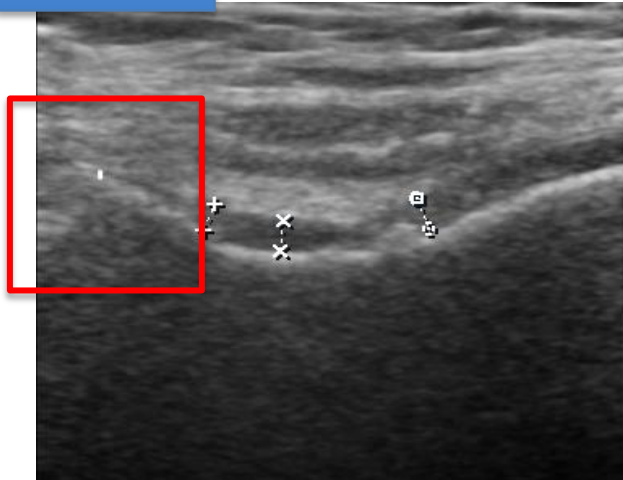
**After 6 month**



# Left knee

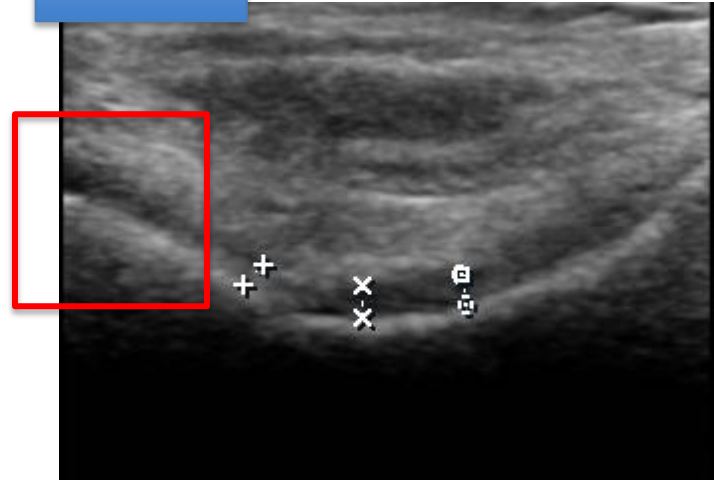
Before 6 month

0.11cm

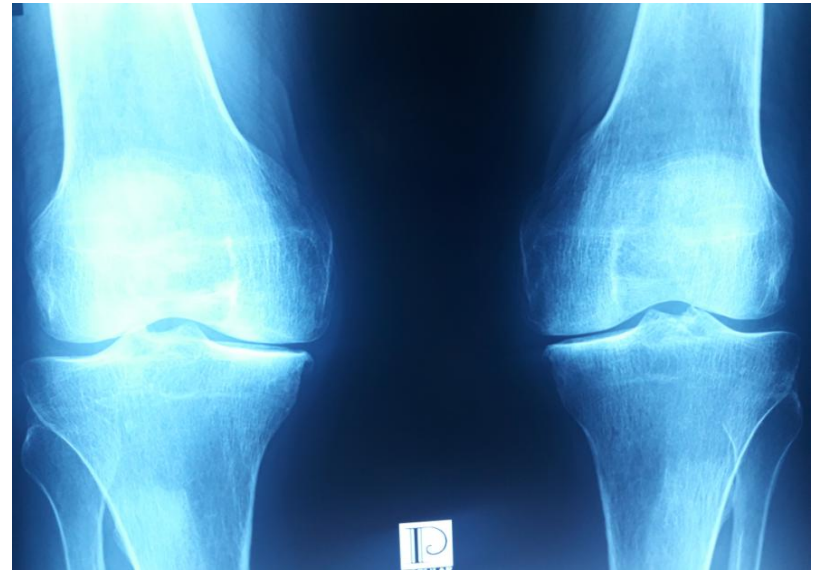


After 6 month

0.14cm

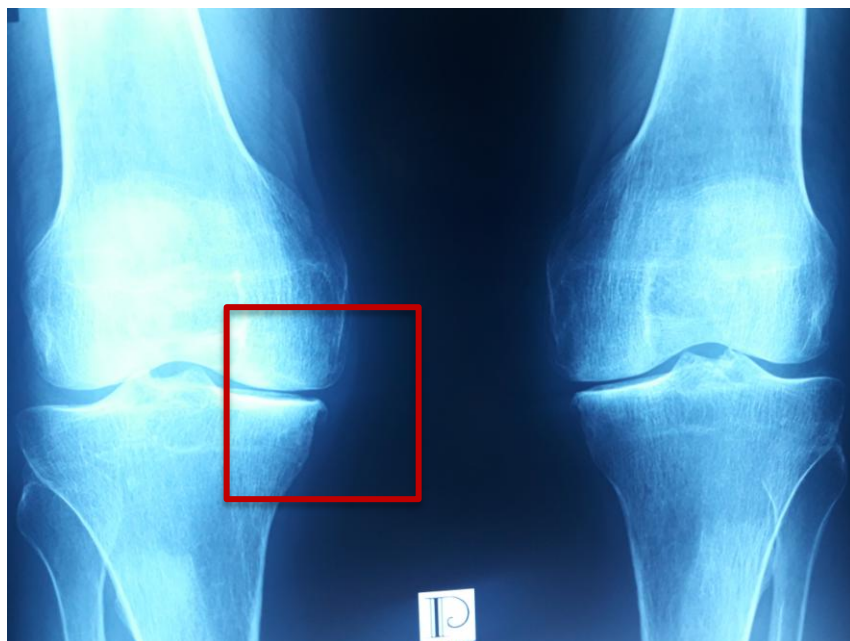


# Case-2

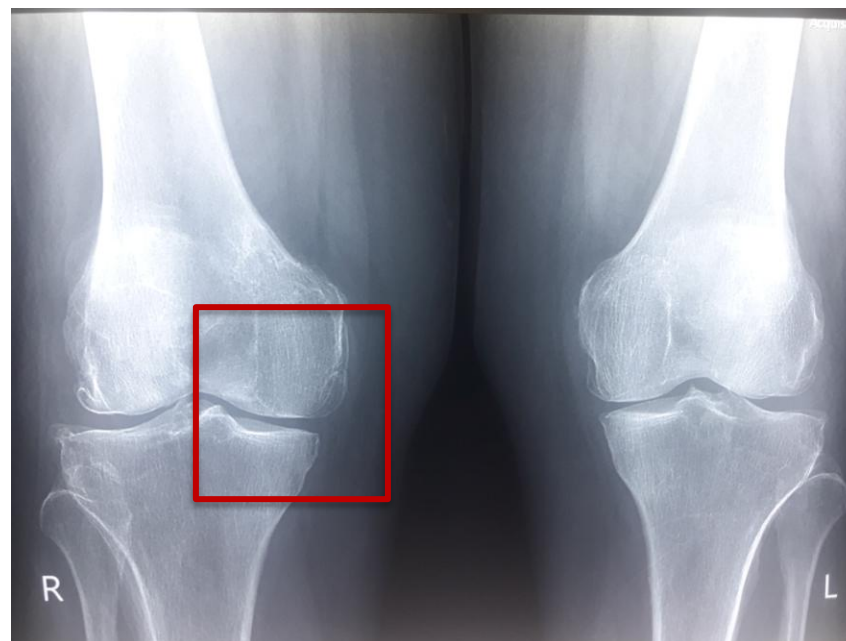




**Before BM-MSCs(16/1/2017)**



**After 6 month of BM-MSCs(24/7/2017)**

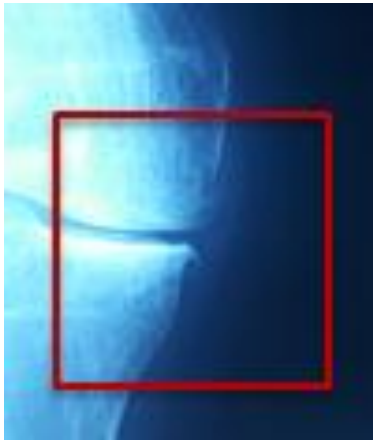




# Right knee

**Before BM-MSCs**

0.2cm



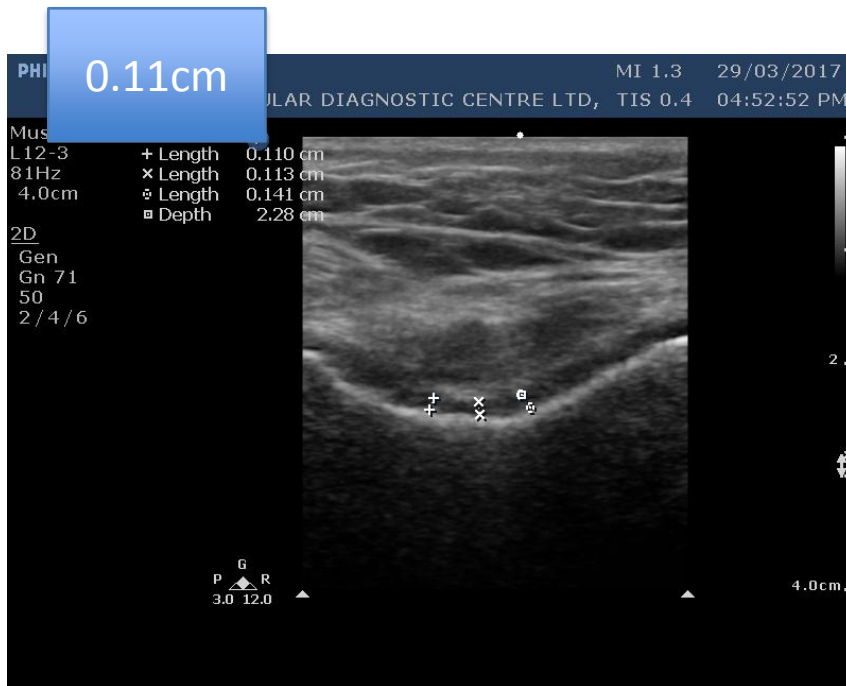
**After 6 month of BM-MSCs**

0.35cm

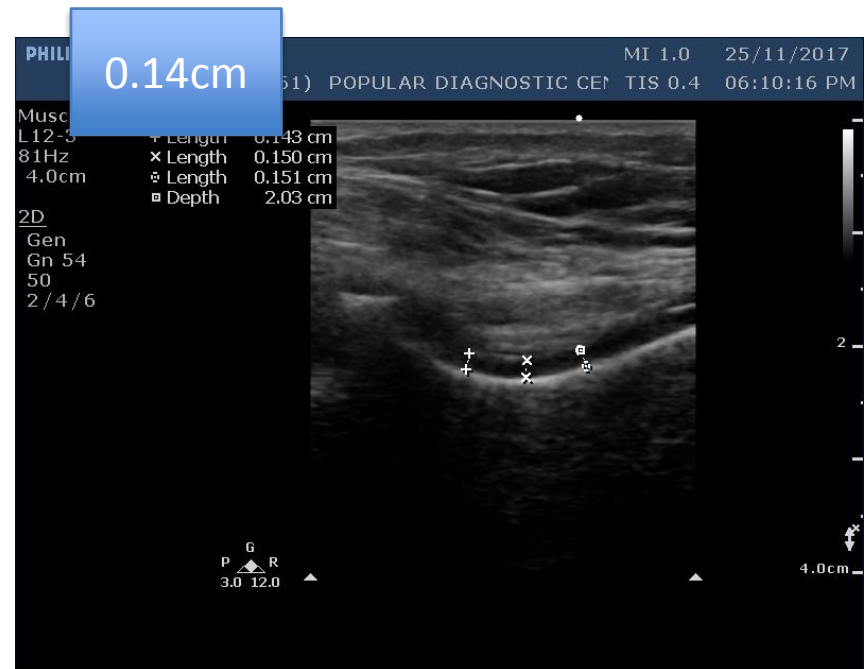


# Right knee

**Before BM-MSCs (0.11cm)  
(16/1/2017)**

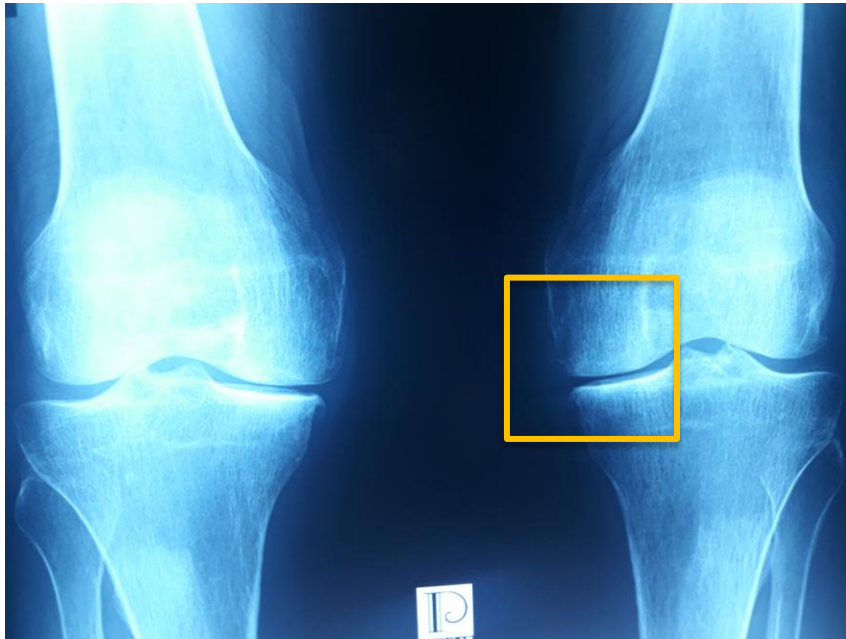


**After BM-MSCs (0.14cm)  
(24/7/2017)**

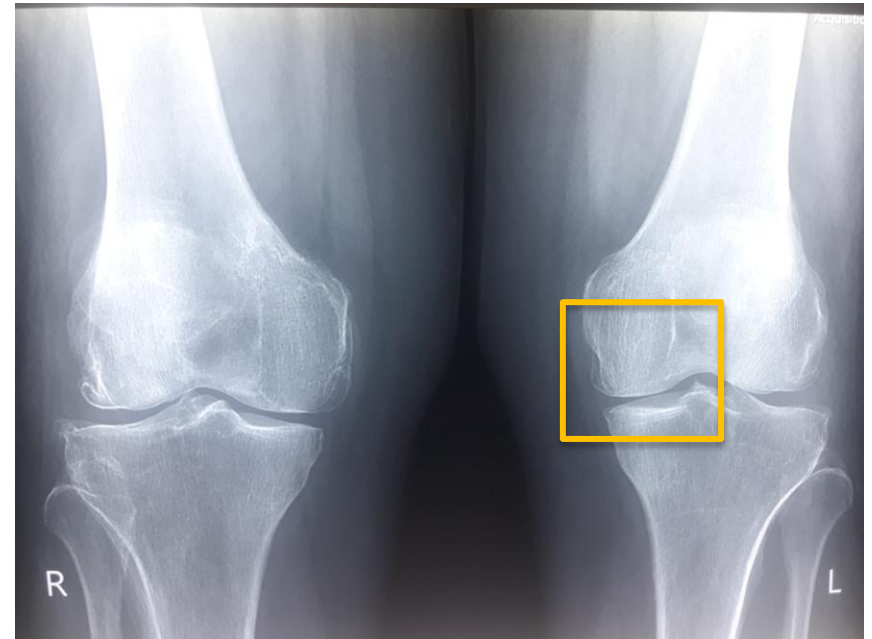


# Left knee

Before BM-MSCs(16/1/2017)

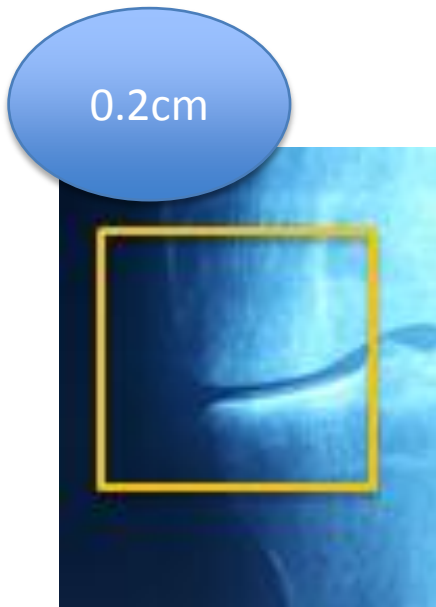


After 6 month of BM-MSCs(24/7/2017)



# Left knee

Before BM-MSCs

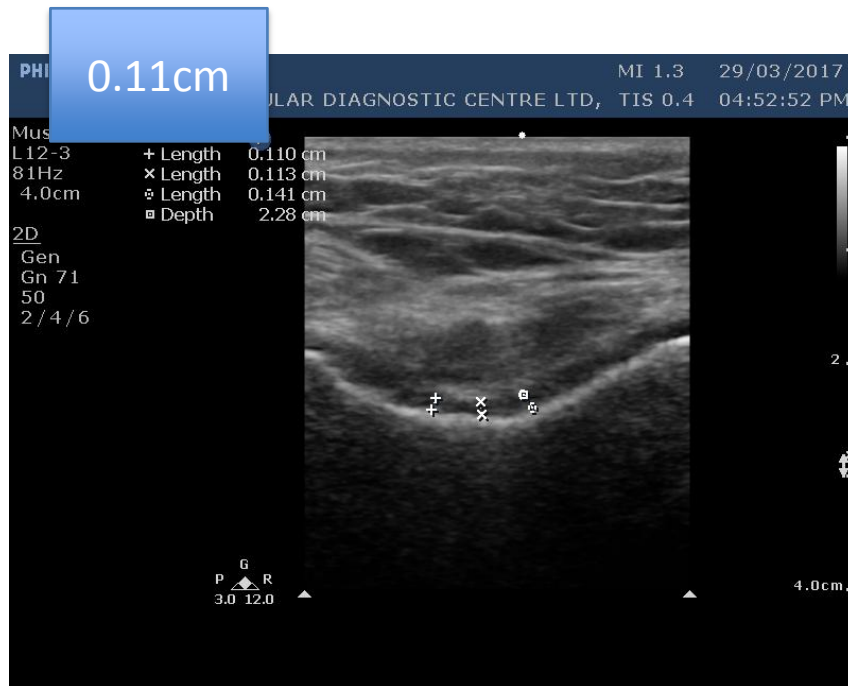


After 6month of BM-MSCs

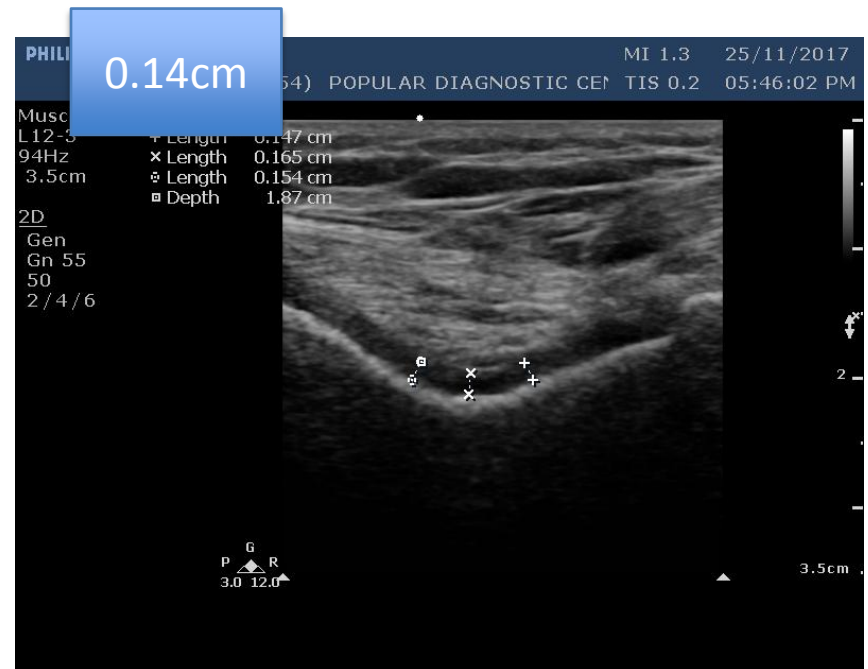


# Left knee

**Before BM-MSCs (0.11cm)**

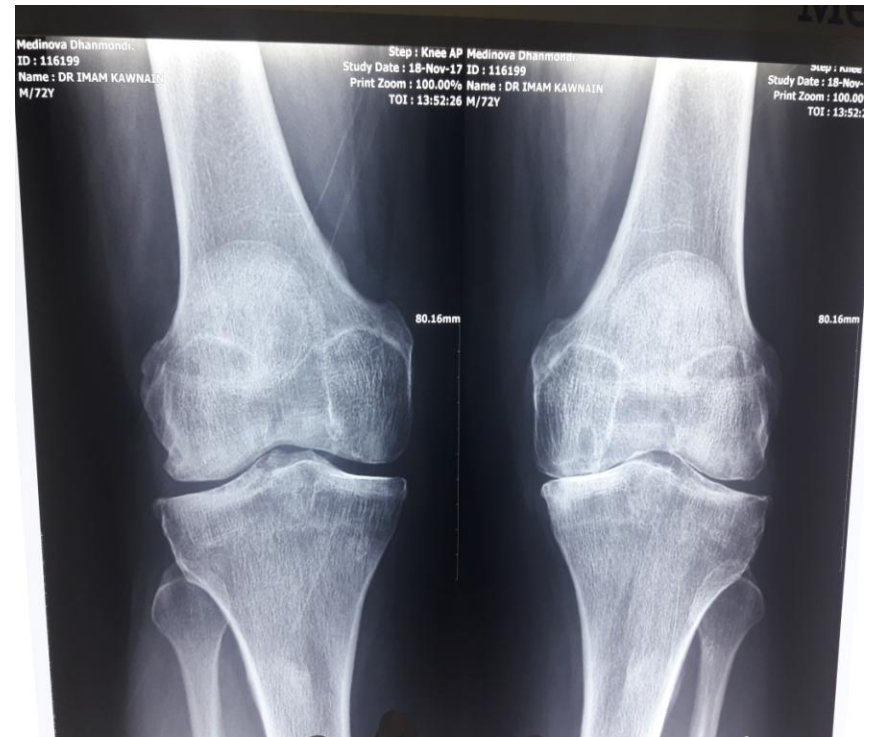


**After BM-MSCs(0.14cm)**





# Case-3





# Right knee

**Before BM-MSCs(1/2/2017)**



**After BM-MSCs (2/7/2017)**



# Right knee

Before

0.35cm



After

0.4cm

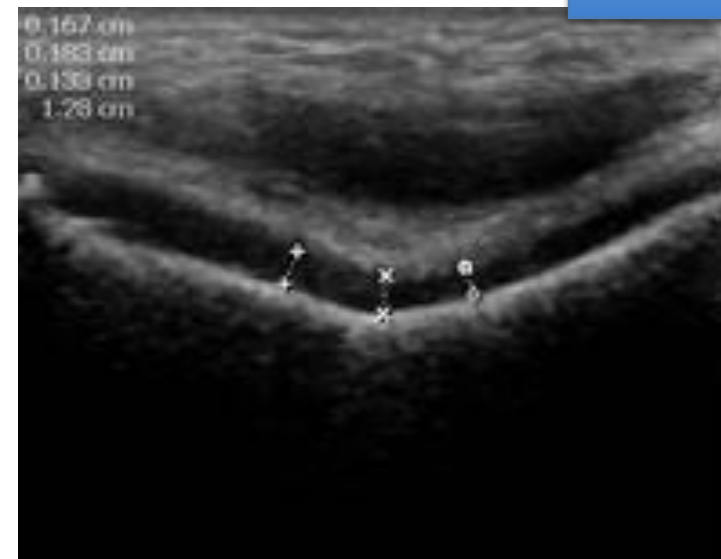


# Right knee

Before BM-MSCs(1/2/2017)  
(0.11cm)

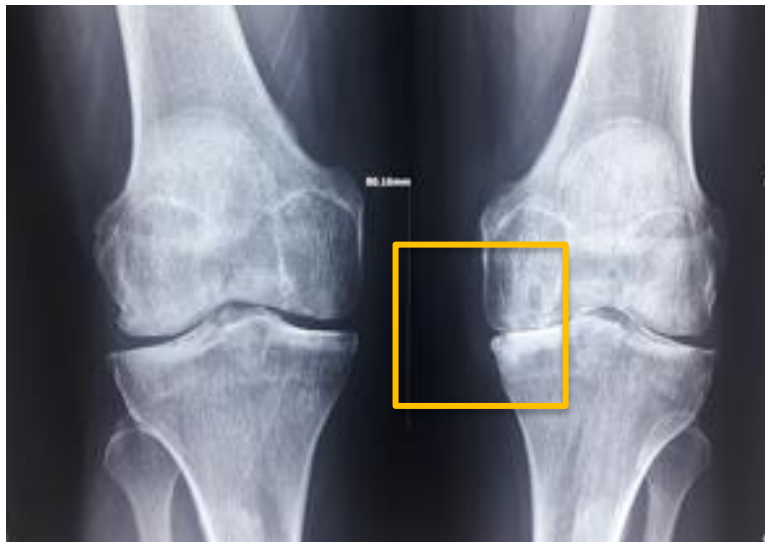


After BM-MSCs (2/7/2017)  
(0.16cm)



# Left knee

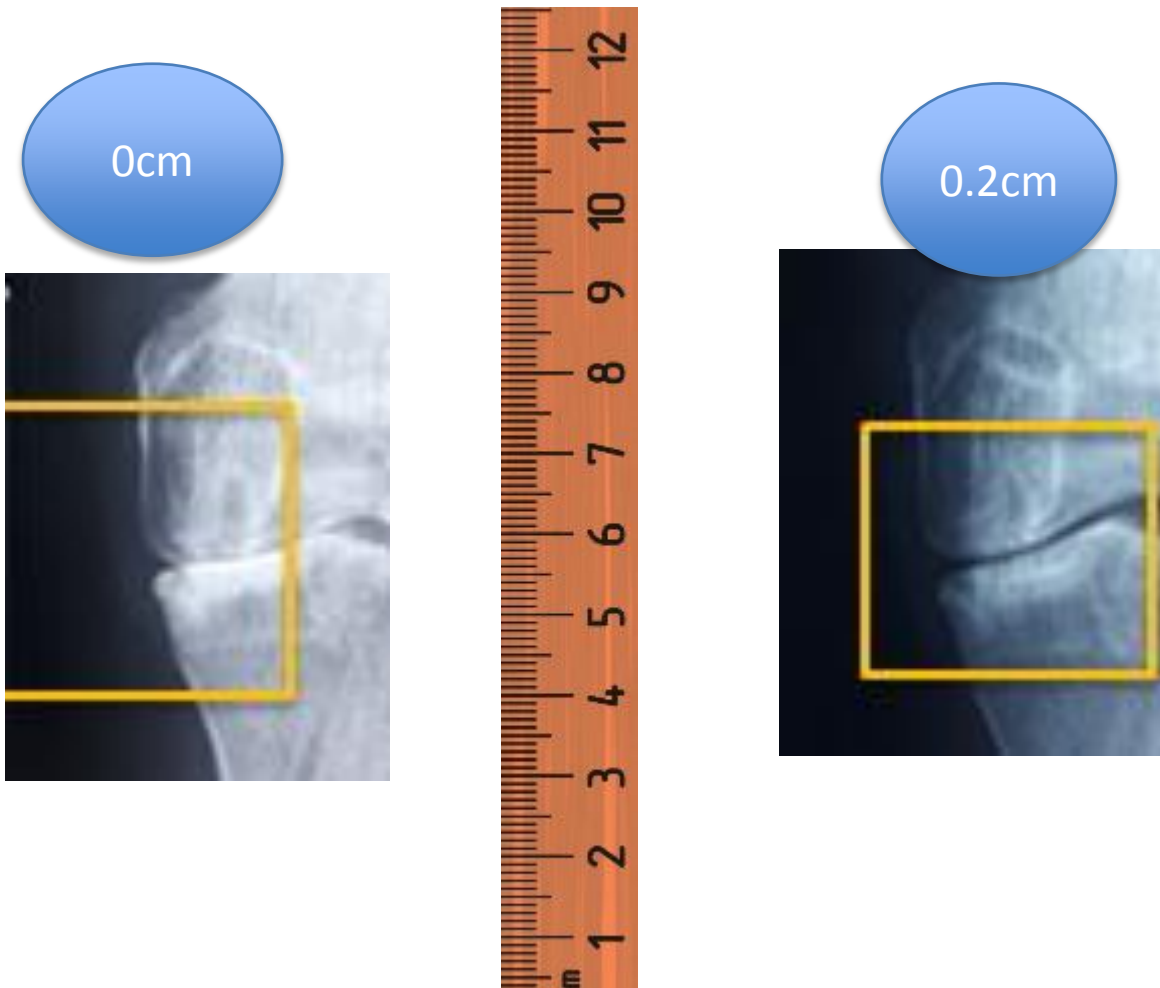
**Before BM-MSCs(1/2/2017)**



**After BM-MSCs (2/7/2017)**



# Left knee



# Left knee

Before BM-MSCs(1/2/2017)  
(0.10cm)

0.10cm



After BM-MSCs(1/2/2017)  
(0.11cm)

0.11cm





- **RESULT**

# Demographic study

- Male:2
- Female:4
- M:F-1:2
- Occupation:  
3Doctors,1 Professor,1 Microbiologist,1 housewife.
- District: Dhaka



# Kellgren and Lawrence system for classification of knee oa

- Case-1:Gr-4
- Case-2:Gr-3
- Case-3:Gr-3
- Case-4:Gr-3
- Case-5:Gr-3
- Case-6:Gr-3



# Swelling & Tenderness

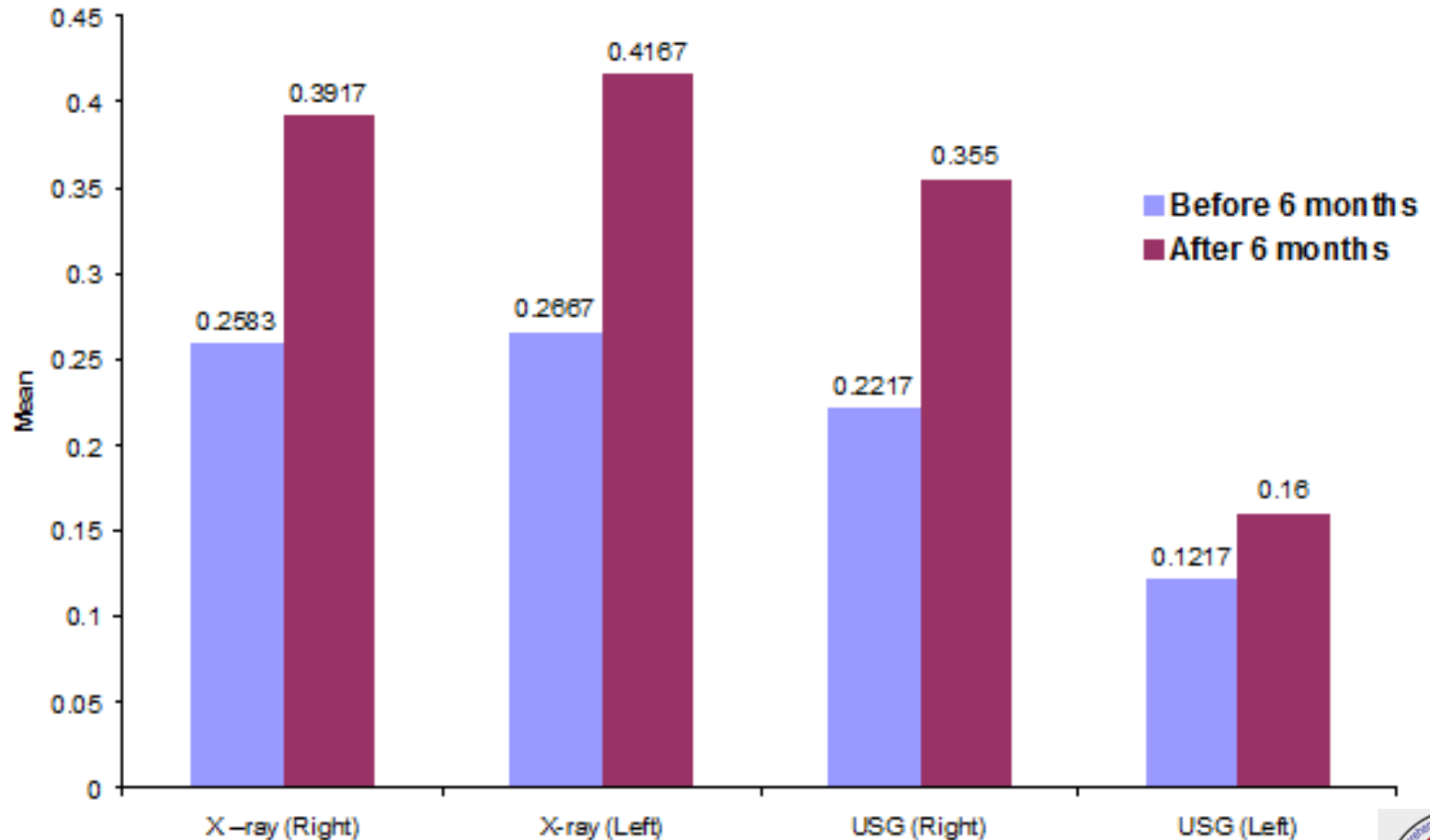
Variables	Before 6 months	2 wks	4 wks	2 months	6 months
<b>Swelling</b>					
Grade O	0	0	6	6	6
Grade I	0	6	0	0	0
Grade II	0	0	0	0	0
Grade III	6	0	0	0	0
Grade IV	0	0	0	0	0
<b>Tenderness</b>					
Grade O	0	0	0	5	6
Grade I	0	0	6	1	0
Grade II	0	6	0	0	0
Grade III	6	0	0	0	0
Grade IV	0	0	0	0	0

# Mean TFD & cartilage thickness

Variables	Before BM-MSCs	After 6 months of BM-MSCs	t-value	P value
X –ray (Right)	0.26±0.21	0.39±0.17	-3.73	0.014*
X-ray (Left)	0.27±0.22	0.42±0.18	-3.50	0.017*
USG (Right)	0.22±0.29	0.36±0.35	0.43	0.570
USG (Left)	0.12±0.03	0.16±0.04	-4.60	0.006*

Data were analyzed by Paired t-test, \*significant

# Mean TFD & cartilage thickness



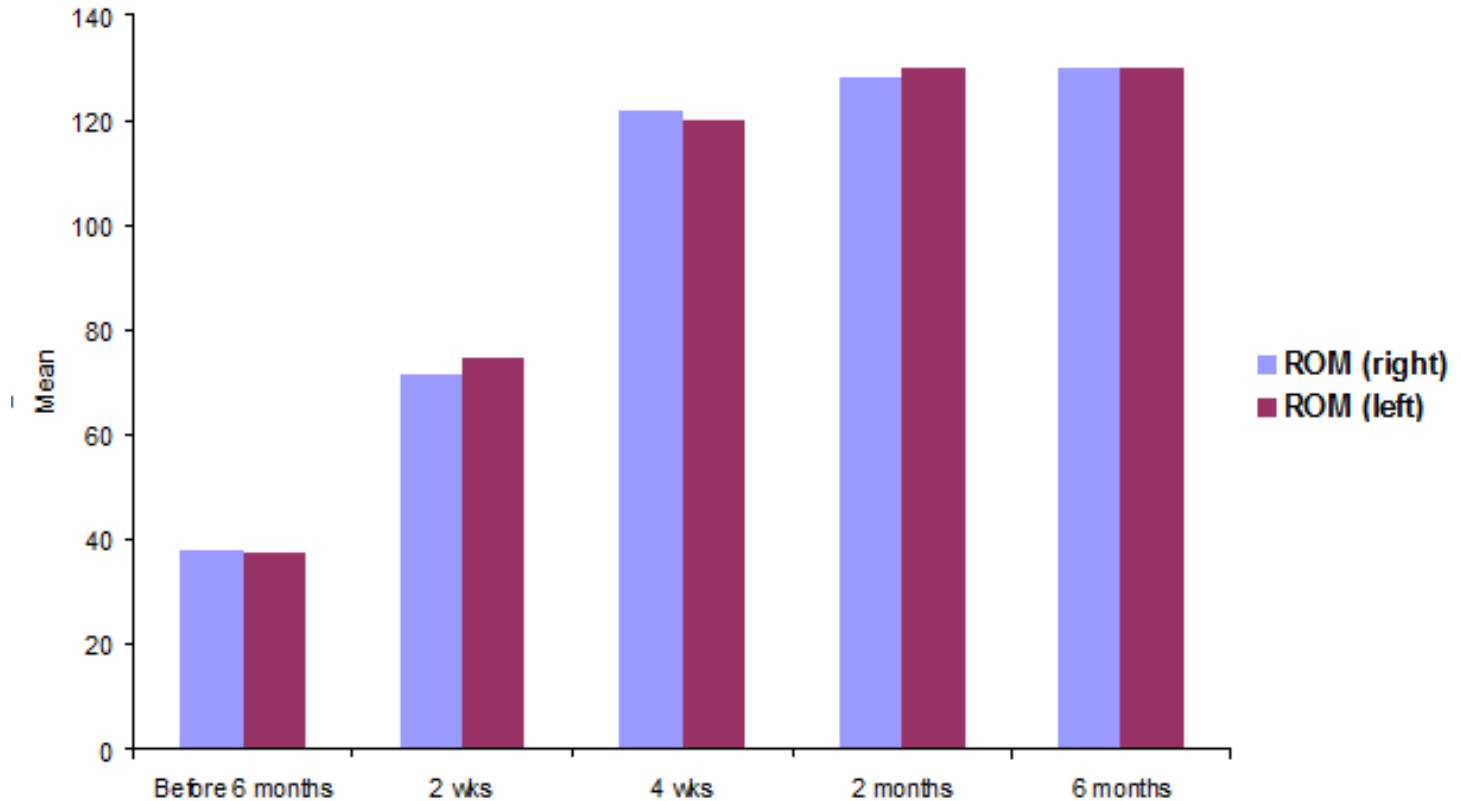


# Mean ROM

Variables	Before BM-MSCs	2 wks	4 wks	2 months	6 months	P value
ROM (right)	38.33±14.38	71.67±16.02	121.67±11.69	128.33±4.08	130.00±0.00	<0.001*
ROM (left)	37.5±17.8	75.0±15.2	120.0±8.9	130.0±0.0	130.0±0.0	<0.001*

Data were analyzed by Paired t-test between before BM-MSCs vs after BM-MSCs,  
\*significant

# Mean ROM

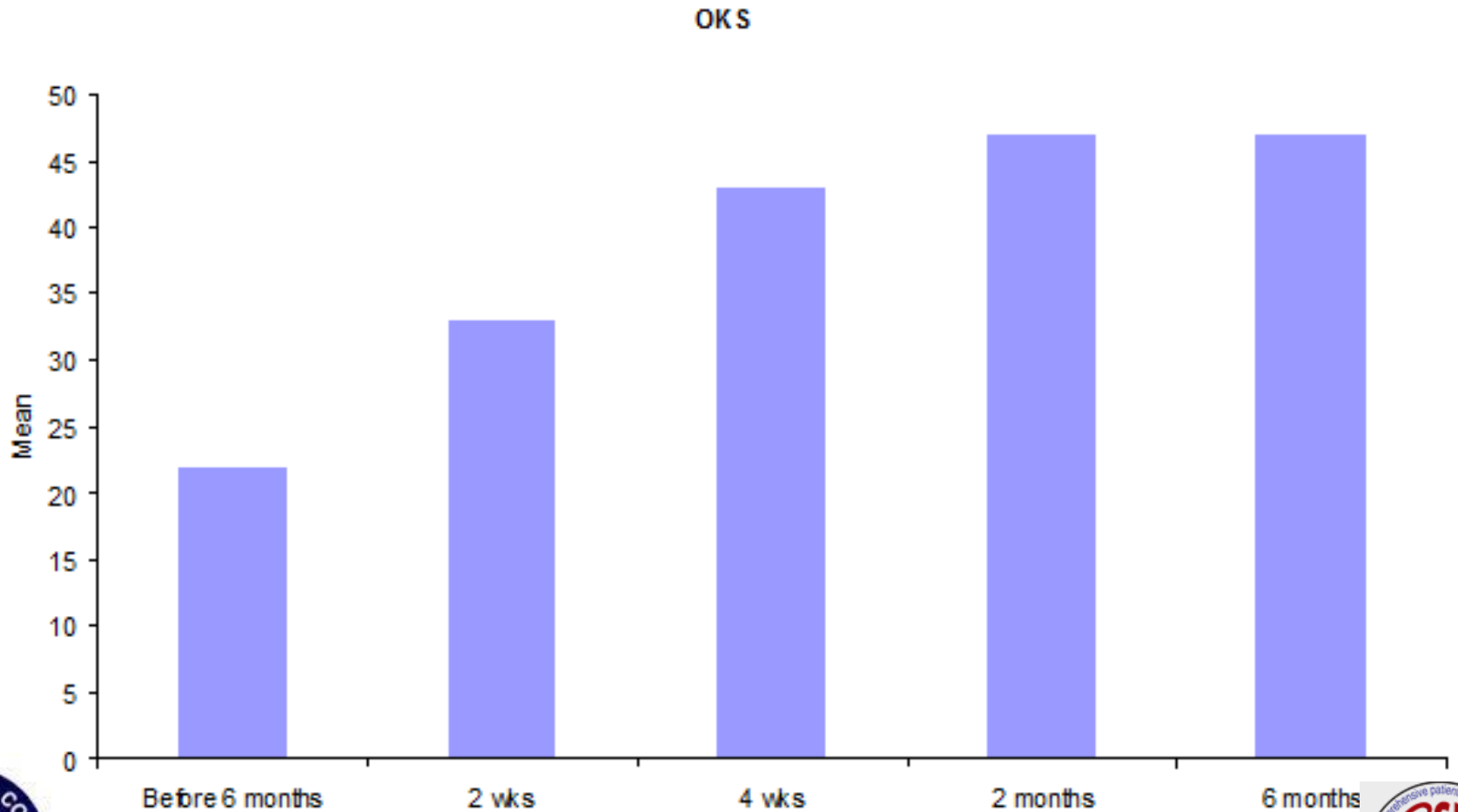


# Mean OKS-Oxford Knee Score

Variables	Before BM-MSCs	2 wks	4 wks	2 months	6 months	P value
OKS	22.0±1.7	33.0±0.0	43.0±3.1	47.0±0.0	47.0±0.0	<0.001*

Data were analyzed by Paired t-test between before BM-MSCs vs after BM-MSCs,  
\*significant

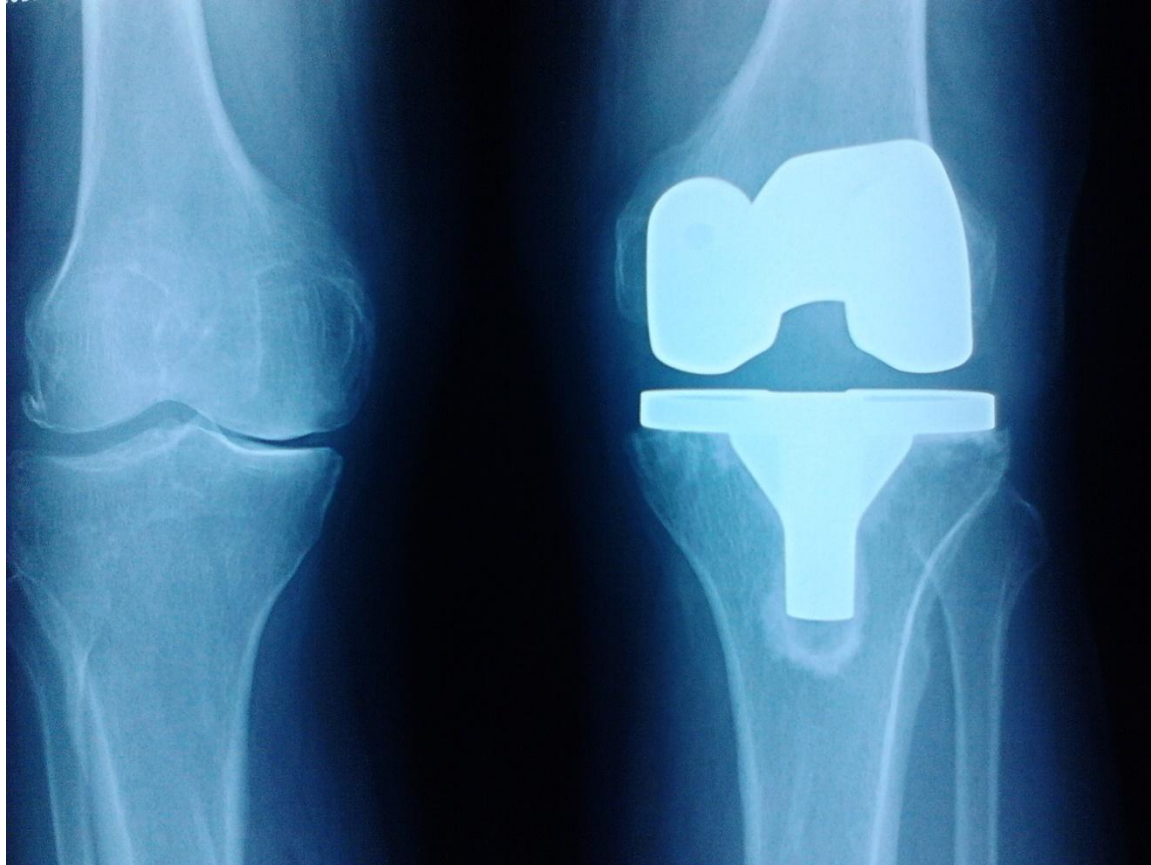
# Mean OKS



# OKS

<b>Score 0 to 19</b>	<b>May indicate severe knee arthritis. It is highly likely that you may well require some form of surgical intervention, contact your family physician for a consult with an Orthopaedic Surgeon.</b>
<b>Score 20 to 29</b>	May indicate moderate to severe knee arthritis. See your family physician for an assessment and x-ray. Consider a consult with an Orthopaedic Surgeon.
<b>Score 30 to 39</b>	May indicate mild to moderate knee arthritis. Consider seeing your family physician for an assessment and possible x-ray. You may benefit from non-surgical treatment, such as exercise, weight loss, and /or anti-inflammatory medication
<b>Score 40 to 48</b>	May indicate satisfactory joint function. May not require any formal treatment.

# We donot want!





# Procedure



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# BMC Aspiration









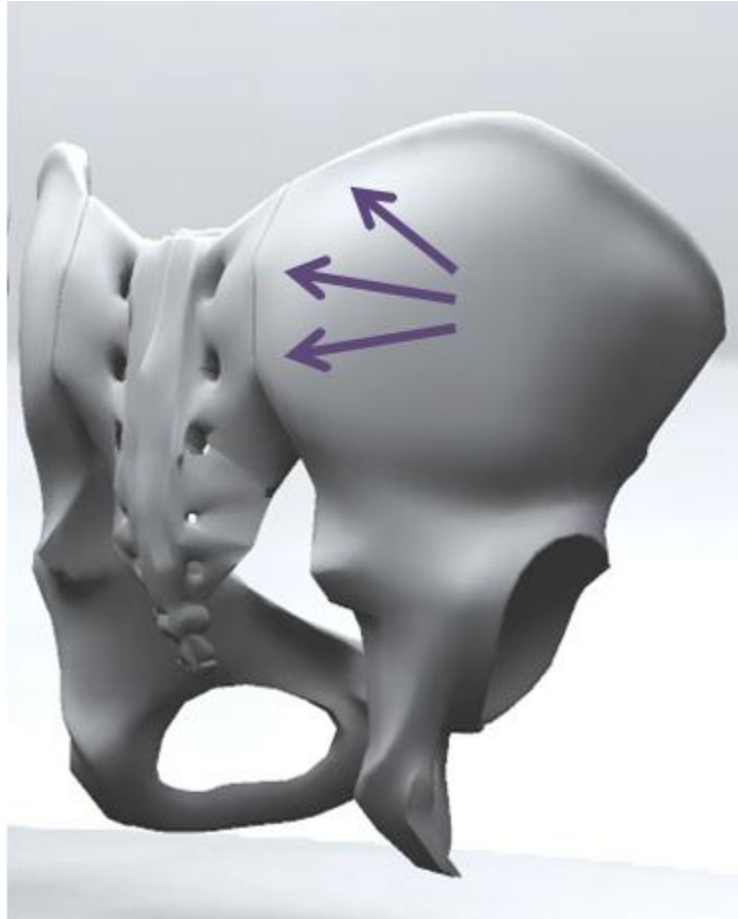
















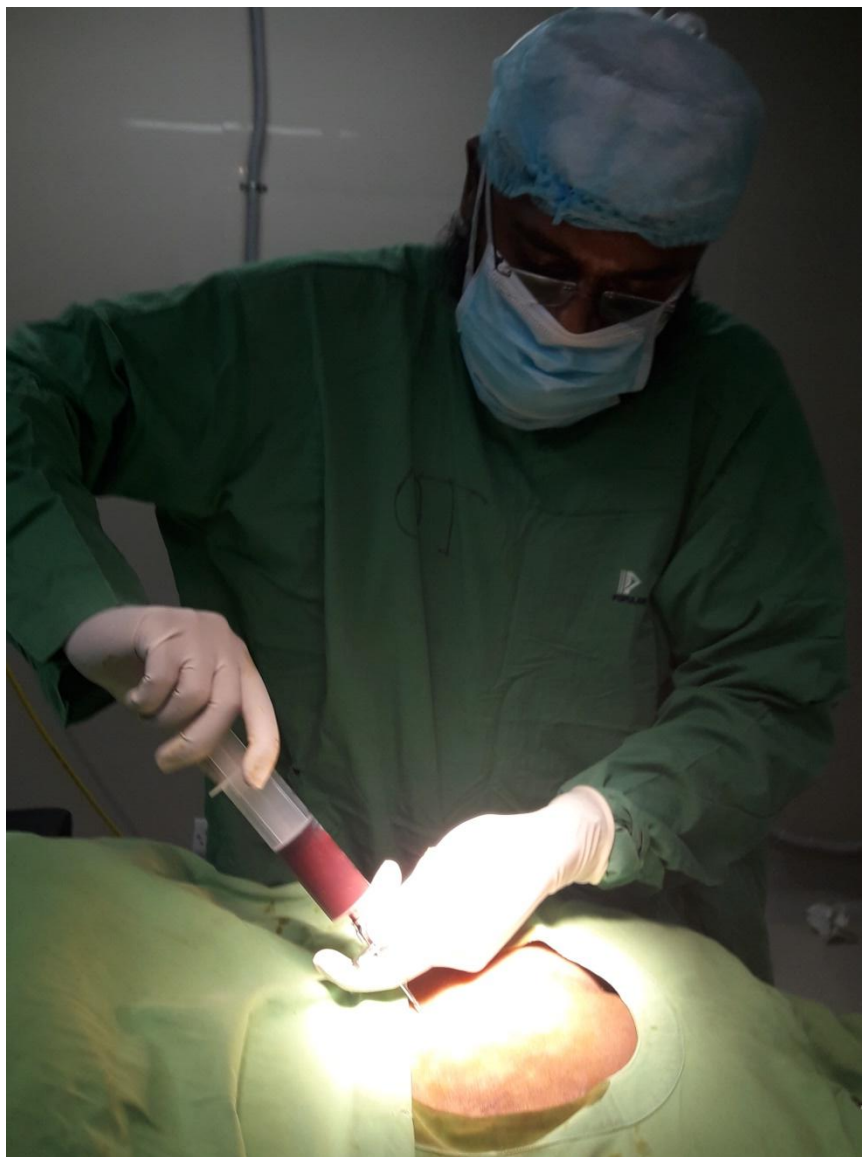




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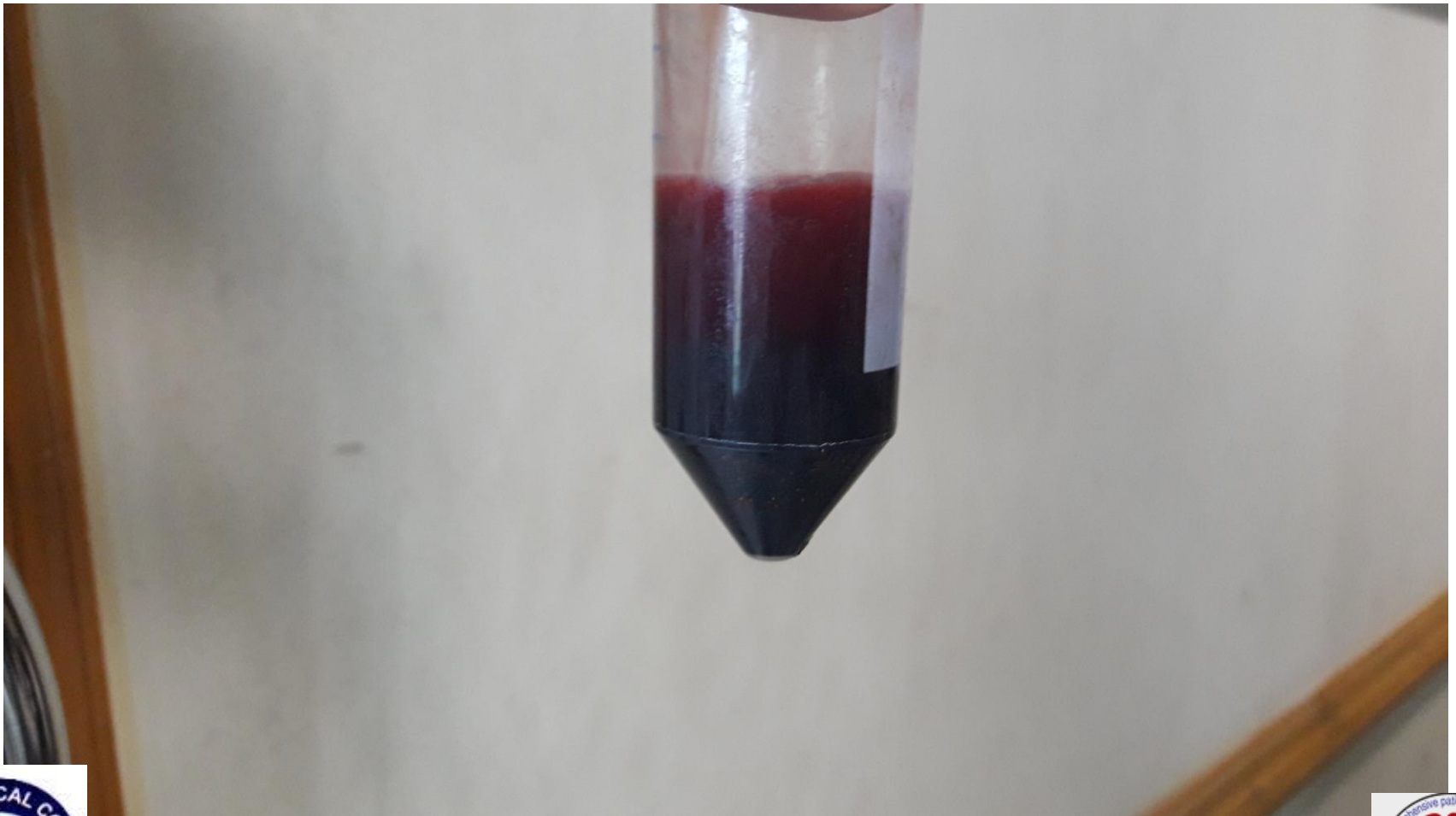
[www.drzamanstemcell.com](http://www.drzamanstemcell.com)



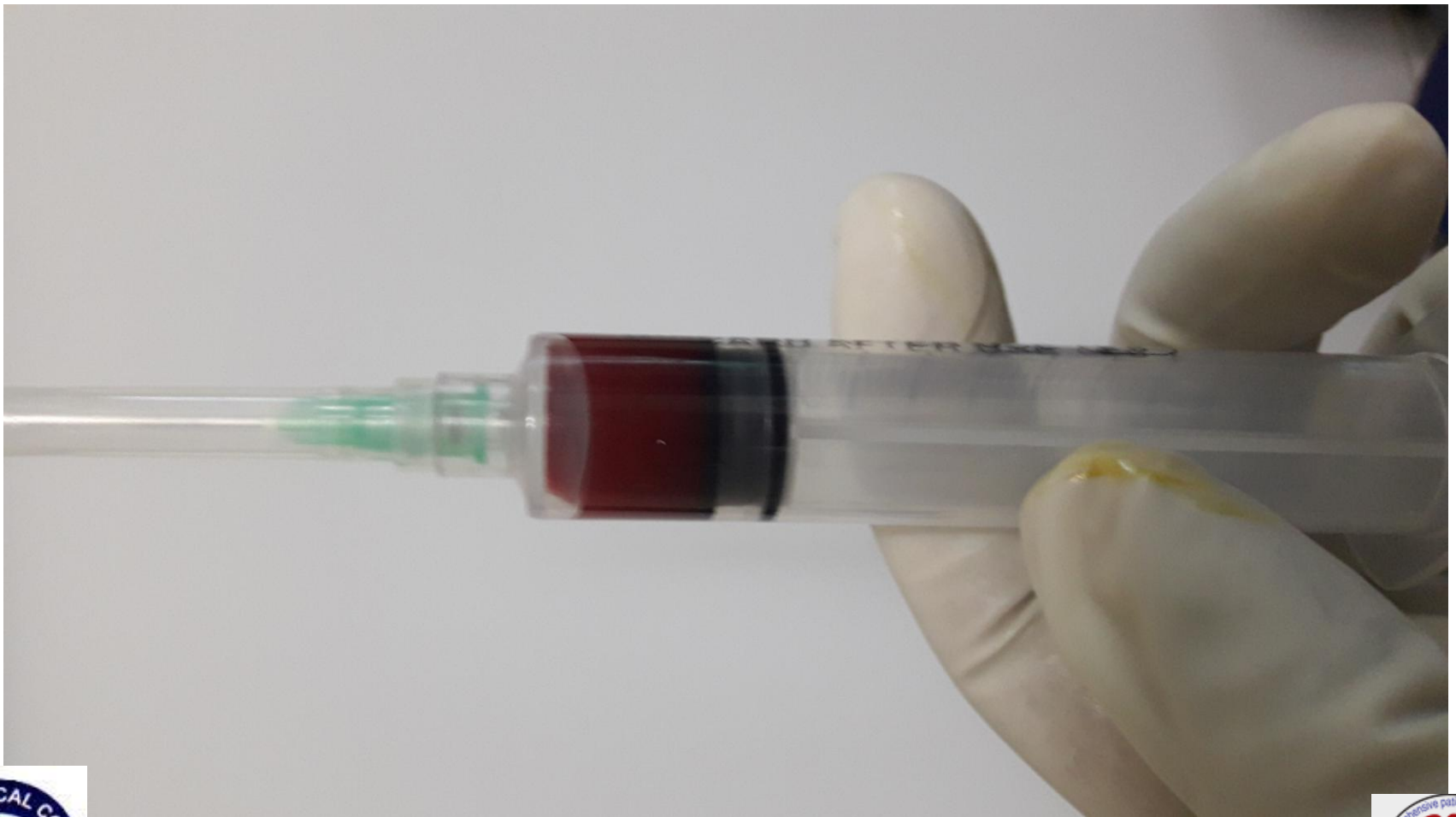


























# Discussion



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# Knee Study in TOBI

Available for follow-up at one year

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- TKA (N=71) 43 Males/28 Females
- BMAC at Knee (N=26) 15 Males/11 Females



# Knee Society Assessment Score

- TKA

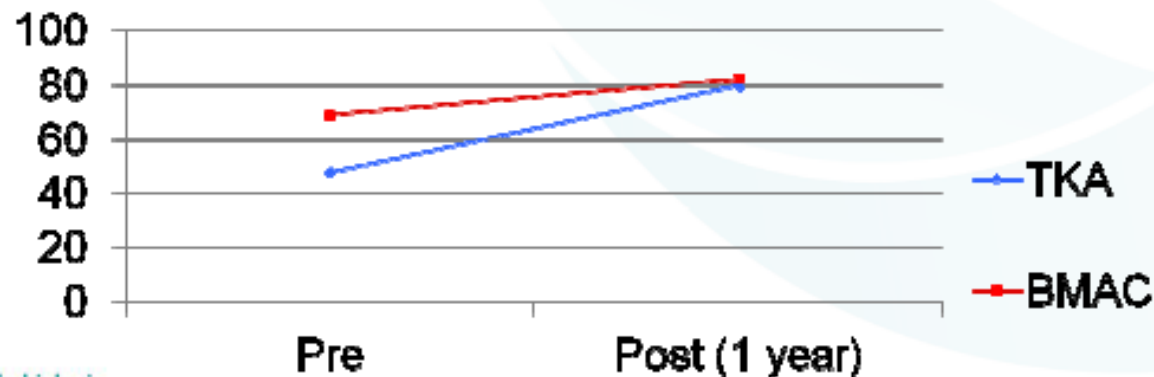
— Pre op 48

— Post op 80

- BMAC

— Pre op 69.08

— Post op 82.44



# Knee Society Function Score

- TKA

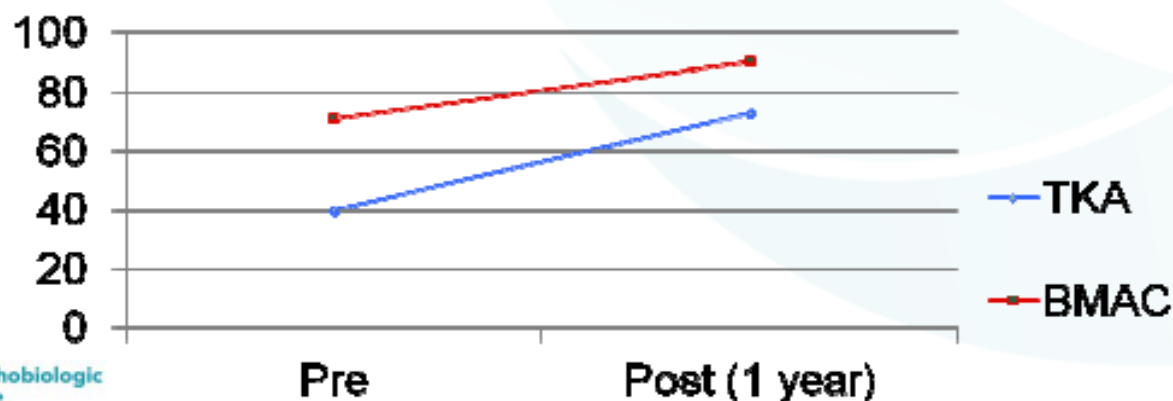
- Pre op 40

- Post op 73

- BMAC

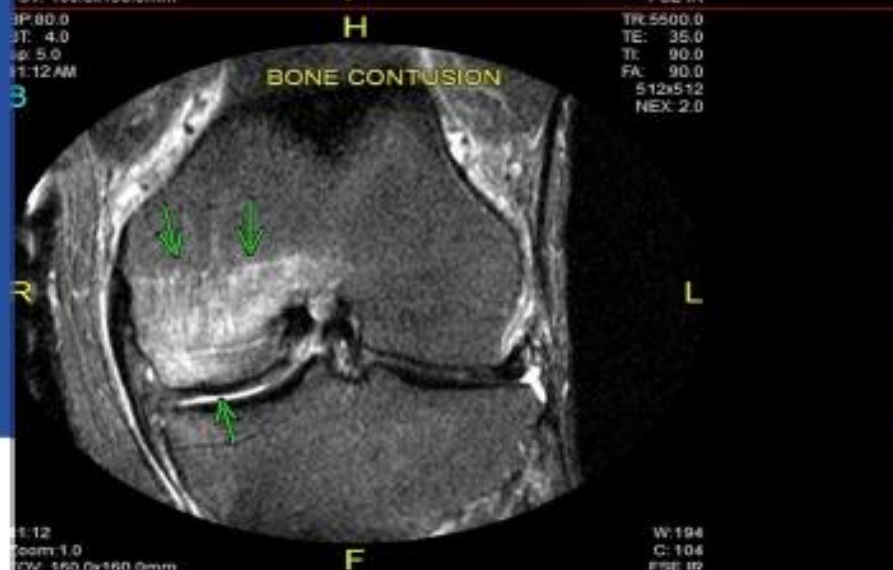
- Pre op 71.15

- Post op 90.31



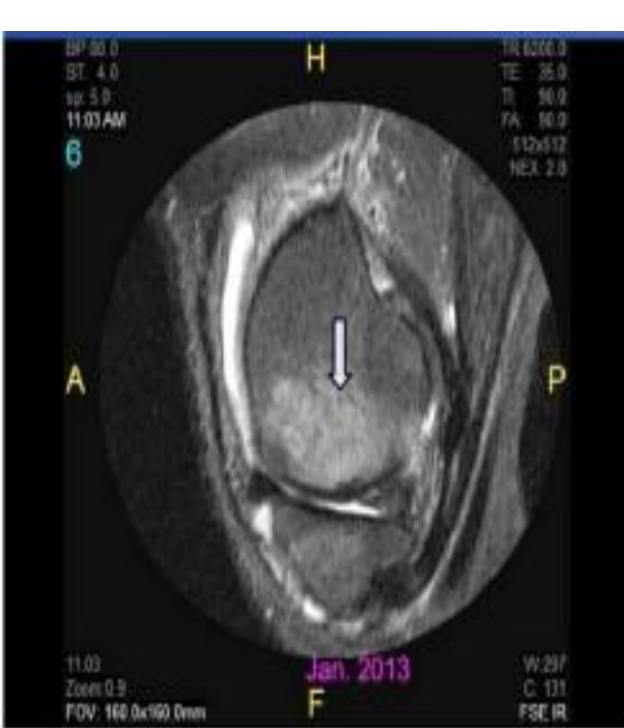
# MRI 8 wks post BMC

Pre

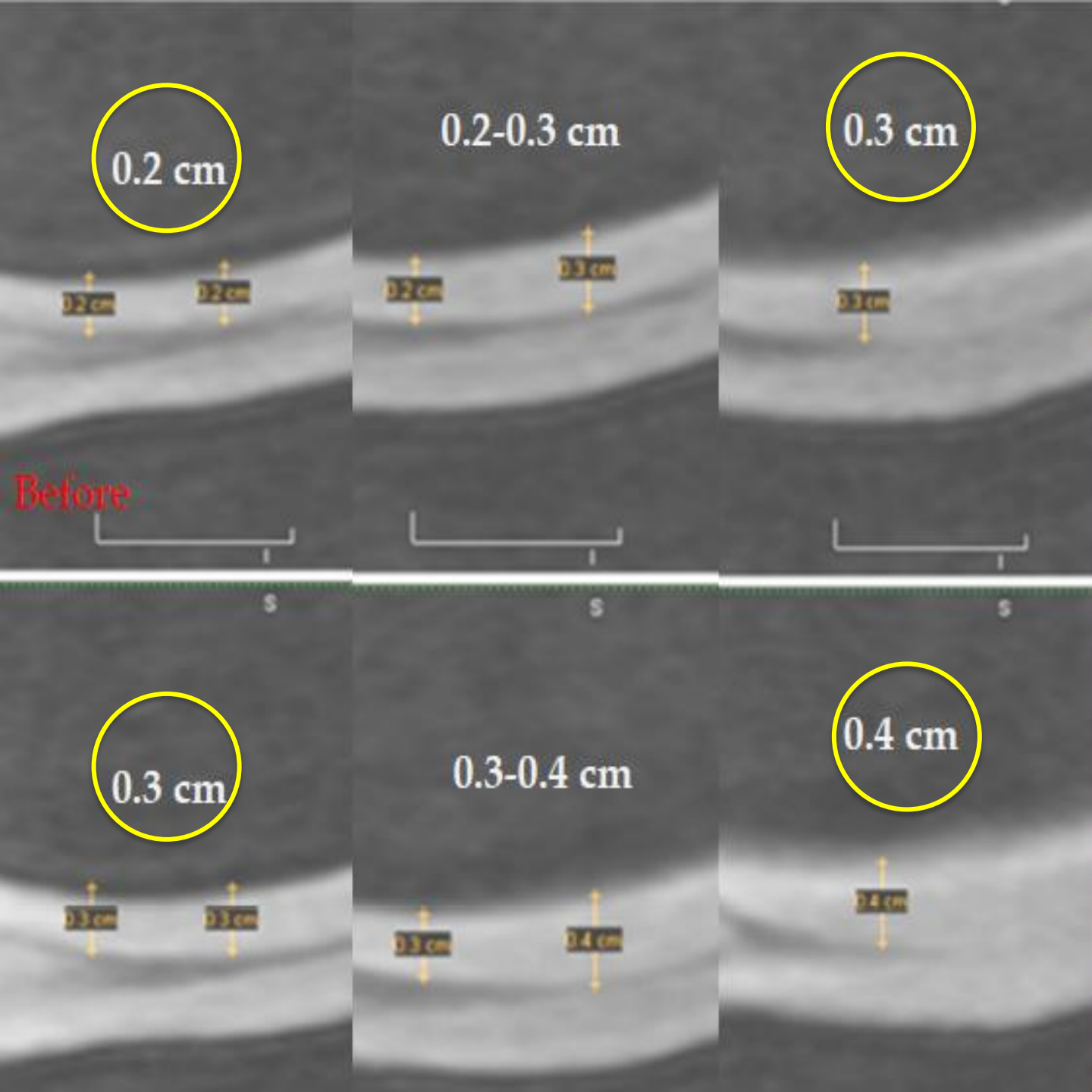


Post









37 yo WM-Before image is 5 months post first MSC transplant. After is 3 months post 2<sup>nd</sup> MSC transplant.  
3D FSPGR FS SAG of medial knee compartment.



# Arthroscopy

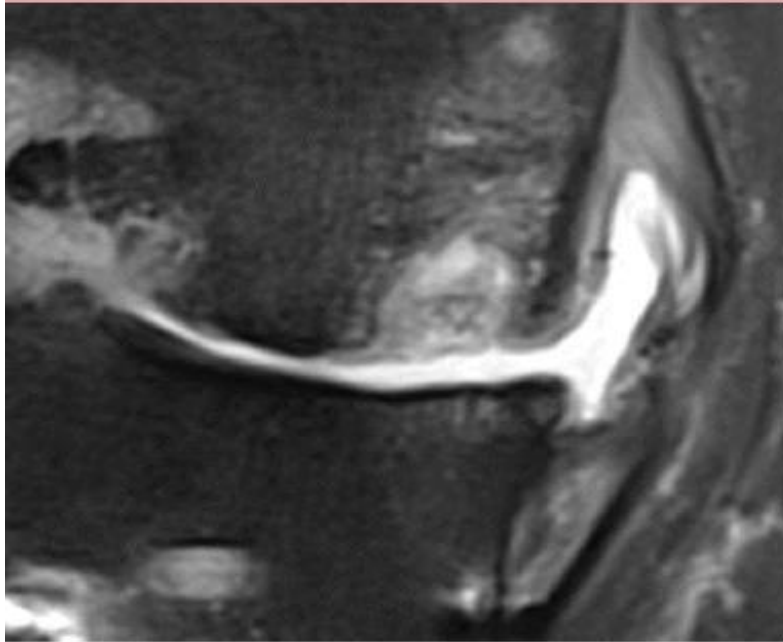
**Before stem-1<sup>st</sup> look**



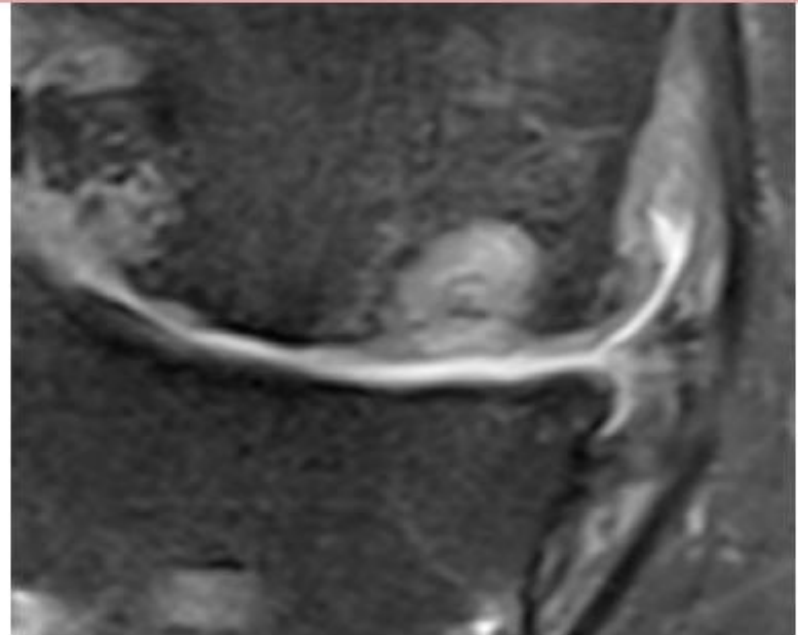
**After 6 month of 2<sup>nd</sup> look**



## Healing of the cartilage defect / meniscus regeneration



**3T MRI before Lipogems® injection**

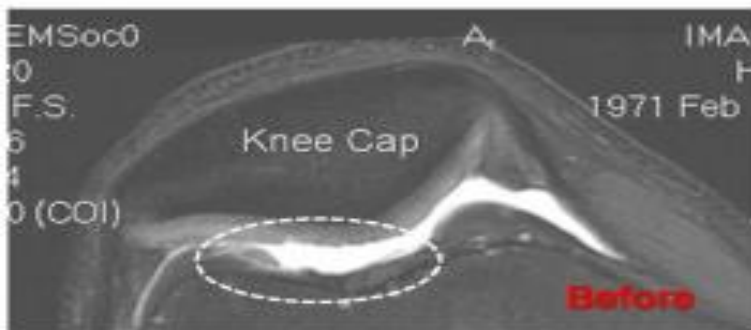


**3T MRI 3 months after Lipogems®**

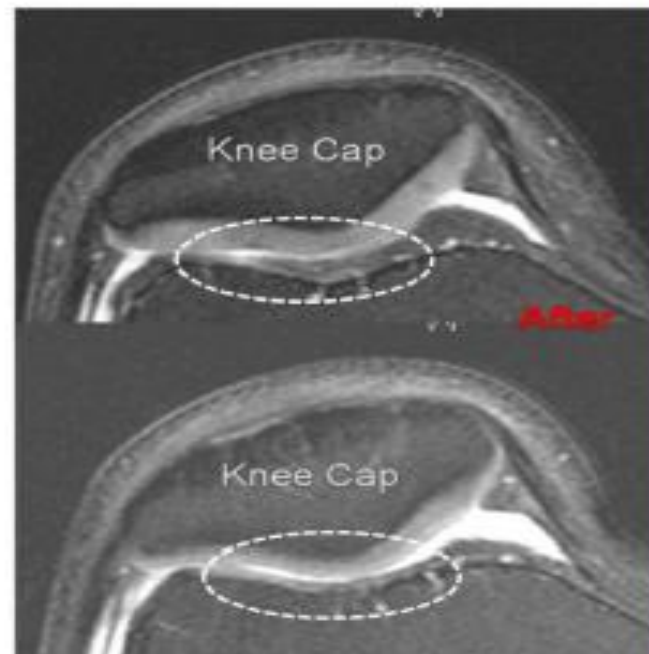
- 60-years-old male patient
- 30 years before he underwent medial meniscectomy.
- Failed Trufit implant 4 years before
- He was treated with high tibial osteotomy 3 years ago, but he was still complaining about the pain and stiffness of the knee.

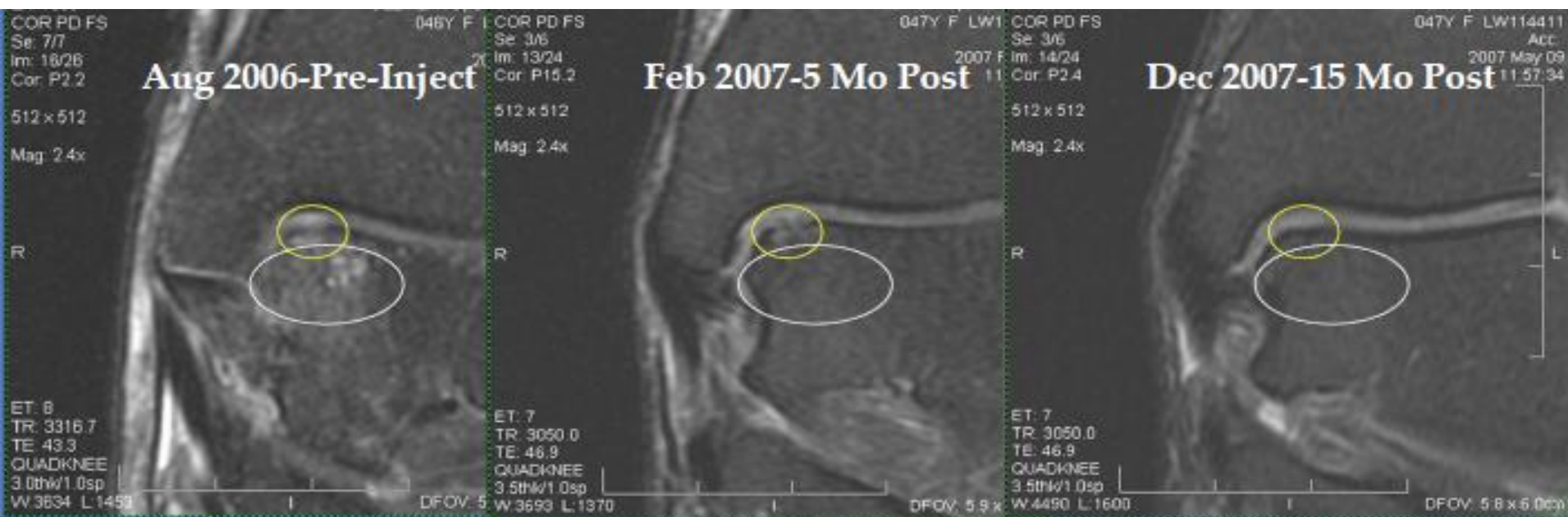
# Chondro-Malacia Patellae

37 yo WM-3 months post 3 injections of autologous mesenchymal stem cells into the medial trochlear groove. 3.0T before and after axial PDFS sequences taken on different magnets.



Note appearance of cartilage in white dashed circle, before image shows ragged appearance with breaks on the patellar surface and the medial trochlear groove surface. The two best match axial slices on the right show improved contour of the cartilage with fill in of the defects.





51 year old otherwise healthy white female status post traumatic talar dome chondral lesion who had failed arthroscopic debridement. Returned to full function.

3.0 Tesla MRI Coronal PDFS serial images of the same slice of the medial ankle/talar dome.

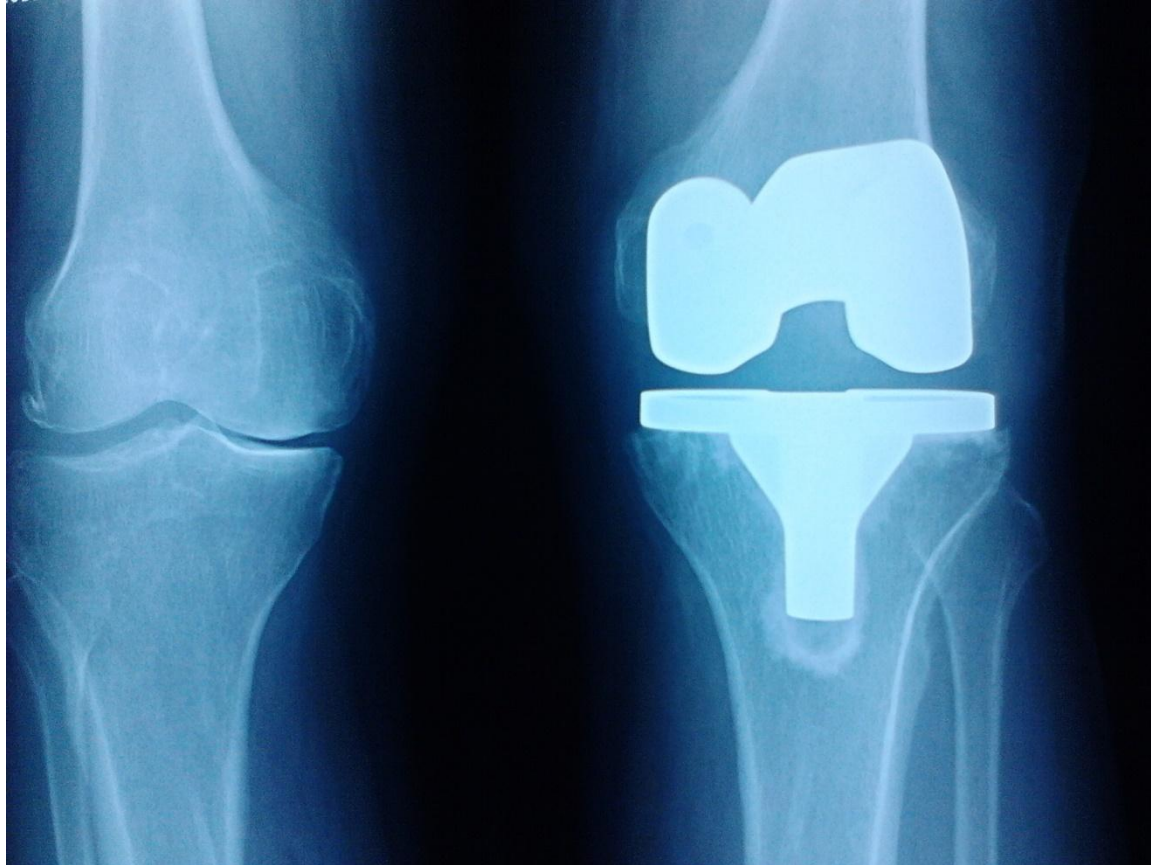
# Regeneration/ Cell therapy

- It's a Paradigm shift!





# We donot want!



# My talk







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**Montrouhet**

**TOBI 2016 Conference**

**Workshop: Lipoaspirate & Bone Marrow  
Concentrate**

**02:30 PM 06:30 PM**



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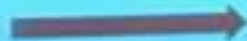
OQUENDO CENTER LAB B

June 12, 2016

TOBI  
The Orthobiologic Institute

TOBI  
Lipo / BMC

TOBI  
The Orthobiologic Institute



No Food or  
Drink in Lab



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8:03

Sunday, June 12



OQUENDO CENTER

SAMSUNG



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# OQUENDO CENTER Main Entrance



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The  
*American Academy of Regenerative Medicine*

Certificate No 312

upon the recommendation of the Board of Directors,  
after completion of all required examination, and  
reviews of the applicant's credentials, we confer upon

*Mohammad Moniruzzaman, M.B.B.S., J.C.P.S.*

Active Member

of the American Academy of Regenerative Medicine  
and from this day forward, 2 February 2017 is entitled to all  
rights and privileges provided by the Board of Directors



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# References

1. <http://www.sciencemag.org/content/336/6082/717.full>
2. <http://www.sciencedaily.com/releases/2012/07/120717131353.htm>
3. [http://biomed.brown.edu/Courses/BI108/BI108\\_2004\\_Groups/Group01/crC.htm](http://biomed.brown.edu/Courses/BI108/BI108_2004_Groups/Group01/crC.htm)
4. [http://www.sciencenews.org/view/generic/id/339669/title/Stem\\_cell\\_treatment\\_spurs\\_cartilage\\_growth](http://www.sciencenews.org/view/generic/id/339669/title/Stem_cell_treatment_spurs_cartilage_growth)
5. <http://www.mc.ntu.edu.tw/department/anatomy/Histology/cartilage.html>
6. <http://theconciergeclinic.com/176/can-osteoarthritis-be-cured/>
7. <http://images.rheumatology.org/viewphoto.php?albumId=75675&imageId=2861658>
8. <http://www.kneesurgeonbristol.co.uk/conditions-treatments/joint-surface-damage.aspx>
9. <http://aseed.coloplast.com/?bone=1>
10. <http://www.sigmaaldrich.com/life-science/stem-cell-biology/mesenchymal-stem-cells.html>
11. Bean, Olivia S., and Eric M. Darling. "Isolation, Characterization, and Differentiation of Stem Cells for Cartilage Regeneration." *Annals of Biomedical Engineering* 40.10 (2012): 2079-2097. Print.





# Take Home Message



- Large scale study.
- Prevent Advanced OA progression by taking early stem cell.
- Save your knee, Save your hip.
- Keep young your Knee/Hip!
- Future medicine, treat yourself by your cells and enjoy the power of cells!

