

Effect of Posterior Osteophytes on Total Knee Arthroplasty Soft Tissue Balance: *Do They Matter?*

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Background

Posterior Femoral and Tibial Osteophytes:

- Can limit or prevent full extension and flexion
- However, do posterior osteophytes tent adjacent capsular and ligamentous structures and effect coronal plane imbalance?

Background

Traditional Gap Balancing Technique:

- Create equal flexion and extension medial and lateral gaps
- Concern that later removal of posterior osteophytes will result in over-correction of gaps
- Recommend preliminary tibial or distal femur and tibia bone cuts
- Remove posterior osteophytes prior to assessing and balancing gaps

Background

Sriphirom Study (European J of Orthopaedic Surgery and Traumatology 2018):

- Measured osteophytes on CT scan
- TKA with tibial resection only and posterior cruciate ligament excised
- Measured extension gap and flexion gaps with computer navigation before and after posterior osteophyte removal

Background

Average Difference in Gap Measurements were Relatively Small (Sriphirom):

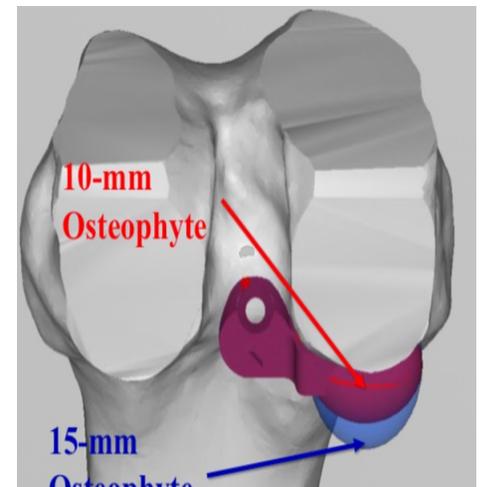
- Medial extension: 0.7mm \pm 0.8mm
- Lateral extension: 0.5mm \pm 1.0mm
- Medial flexion: 0.7 mm \pm 1.0mm
- Lateral flexion: 1.0mm \pm 1.4mm

- They found that there was a significant relationship between the osteophytes size and increase in flexion gaps and lateral extension gaps

Background

Holst et al:

- Evaluated the effects of 10 and 15mm posterior osteophytes (fabricated inserts) on contact pressures using Orthosensor
- Presence of posterior osteophytes caused a increase in medial contact force from 0-45 degrees



Study Objective

- Determine what effect the posterior osteophyte size and location and their subsequent removal had on gap measurements
- Evaluation any effects that initial alignment and pre-operative range of motion may have on coronal gap balancing

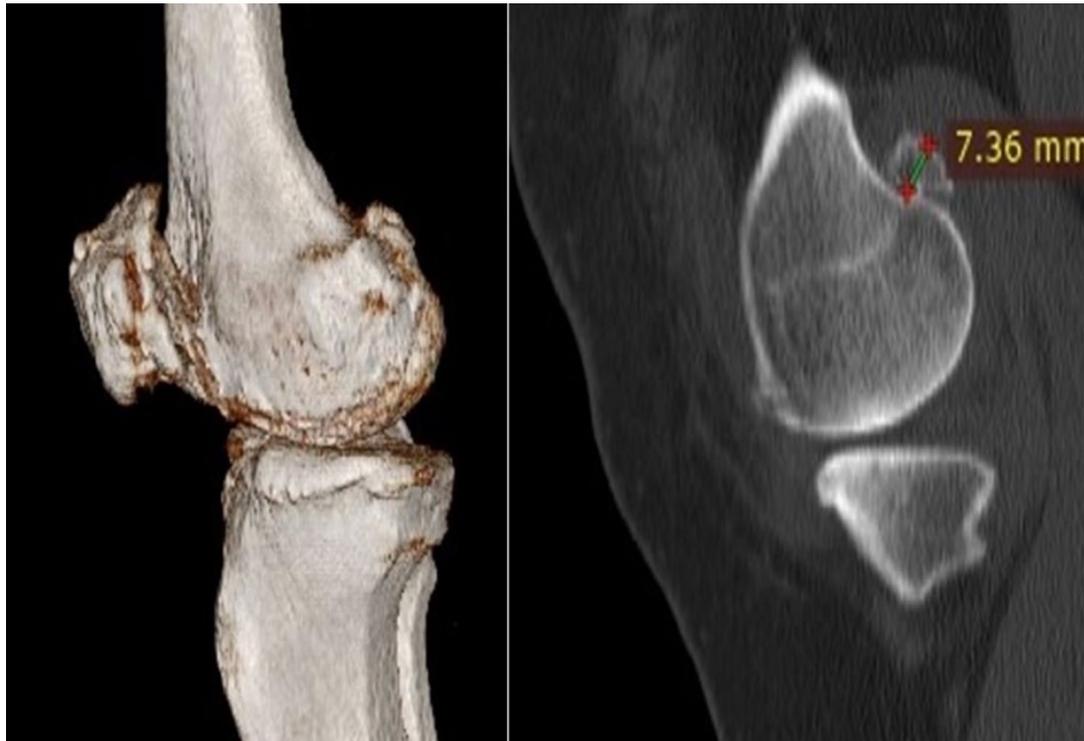
Methods

- Retrospective review of intraoperative data on 245 robotic-arm assisted total knee arthroplasties



Methods

- Determine location and size of posterior tibial and femoral osteophytes measured on pre-operative CT scan



Methods

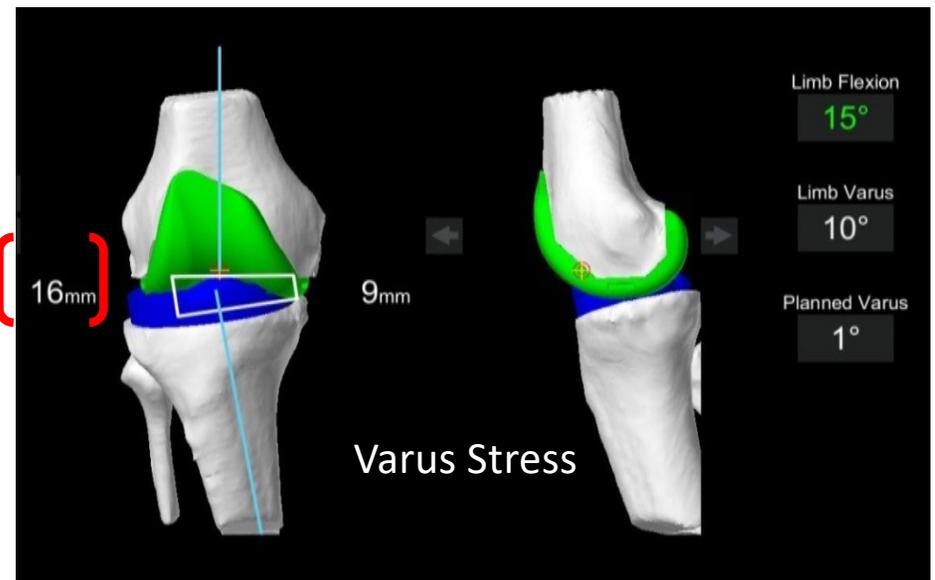
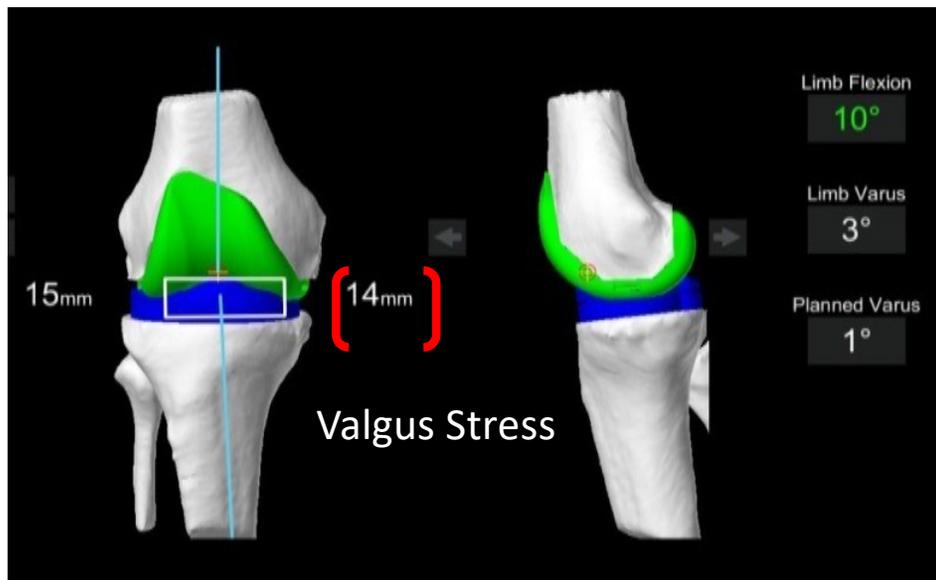
Initial Exposure:

- All medial and lateral osteophytes are removed as best as possible

Methods

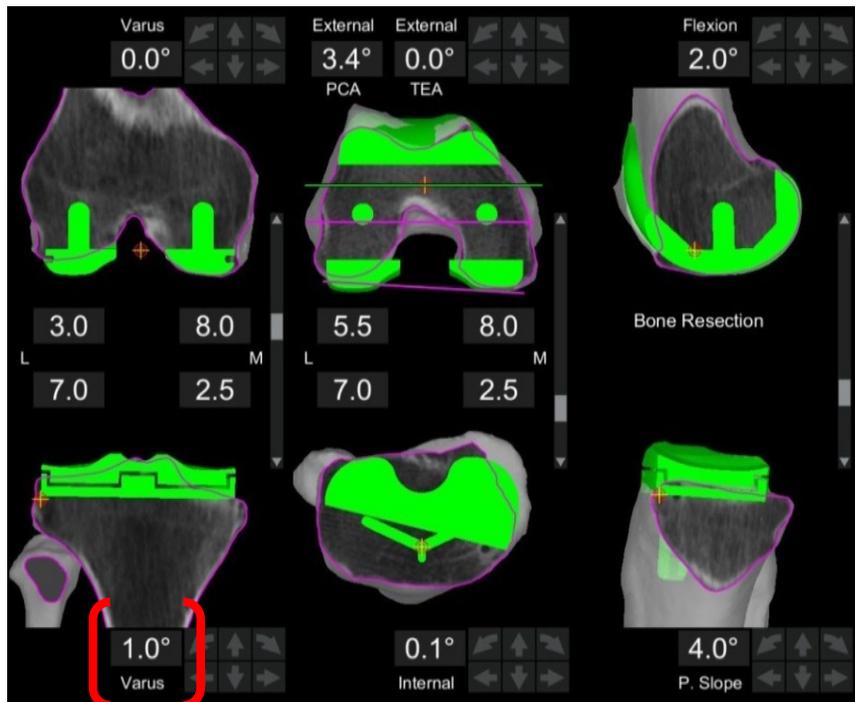
Initial Gap Balance (Pose Capture):

- Varus and valgus stress applied to determine size of medial and lateral gaps at approximately 10 and 90 degrees of flexion

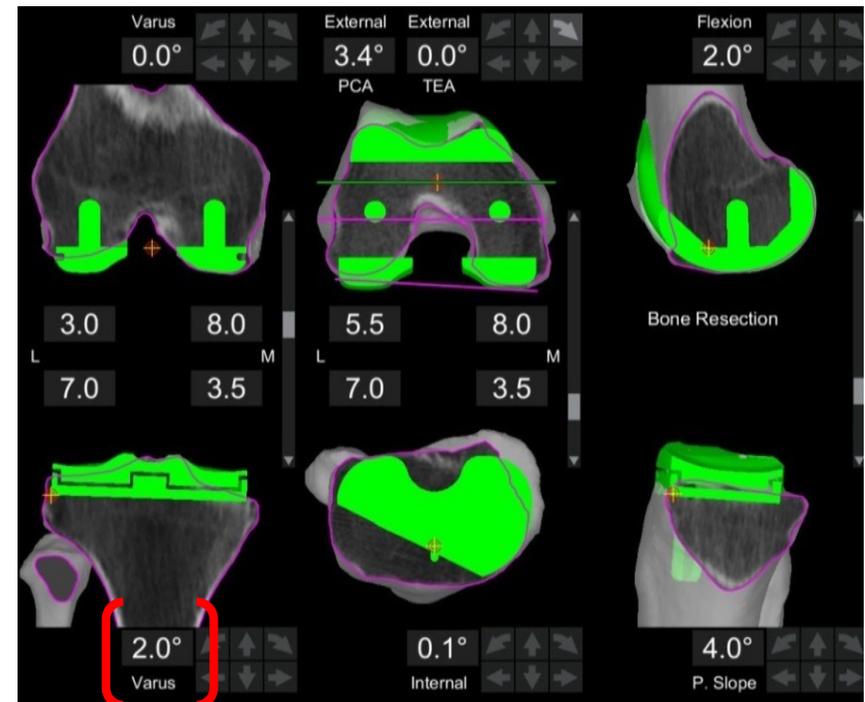


Methods

- Implant positions may be changed to assist with balance
- Effect on gap recorded
- If change was made these values were used for analysis



Initial PreOp Plan



Modified PreOp Plan

Methods

Trialing:

- All bony cuts were performed and the posterior osteophyte have been removed
- Medial and lateral gap measurements under varus and valgus stress at 10 and 90° of flexion are recorded

Methods

Study Population- Two Cohorts:

- Posterior osteophytes were present:
76% of cases (N =187)
- No osteophytes were present:
23% of patents (N = 58)

Methods

Data Analysis:

- Comparative analysis of patients who had osteophytes and those who did not
- Size and location of osteophytes and affect on gaps were compared using using paired t-tests, independent t-tests, and Pearson's correlation

Results – Average Size

Osteophyte Location	Average Size
Posterior medial femoral	5.7 +/- 3.0mm
Posterior lateral femoral	4.5 +/- 3.0mm
Posterior medial tibial	4.7 +/- 3.1 mm

Results

Evaluation of gap change with and without osteophyte between Pose-Capture and Trialing:

- There is a significant increase in all gaps for both groups

<i>Gap Type (no osteo)</i>	<i>Pose- Gap (mm)</i>	<i>Trialing Gap (mm)</i>	<i>Δ Gap (mm)</i>	<i>Sig</i>
Medial Extension	18.07 ± 2.07	19.81 ± 1.71	1.74 ± 1.73	<0.0001
Lateral Extension	19.43 ± 1.8	20.43 ± 1.67	0.93 ± 1.53	<0.0001
Medial Flexion	17.74 ± 2.53	19.22 ± 2.04	1.48 ± 1.98	<0.0001
Lateral Flexion	19.43 ± 1.63	20.05 ± 1.481	0.62 ± 1.66	<0.0001
<i>Gap Type (osteo)</i>	<i>Pose- Gap (mm)</i>	<i>Trialing Gap (mm)</i>	<i>Δ Gap (mm)</i>	<i>Sig</i>
Medial Extension	18.4 ± 2.2	19.7 ± 1.8	1.29 ± 1.7	<0.0001
Lateral	19.61 ± 1.98	20.53 ± 1.7	0.91 ± 1.63	<0.0001

Results

- No Significant Difference when Comparing change in Gaps between Non-osteophyte and Osteophyte cohorts

Difference in Gaps	P Value
Medial extension	0.091
Lateral Extension	0.724
Medial flexion	0.635
Lateral Flexion	0.513

Results

Evaluation of Change in Gaps with Osteophytes < 5mm, 5-10mm, > 10mm:

- There was no significant difference in the changes in gaps between pose-capture and trialing with any size osteophyte at any location

Osteophyte size	<5 mm	≥5 mm	>10mm	p-value
Medial	N = 84	N = 80	N= 17	> 0.05
Lateral	N =58	N= 28	N = 4	> 0.05
Tibial	N = 52	N = 26	N = 7	> 0.05

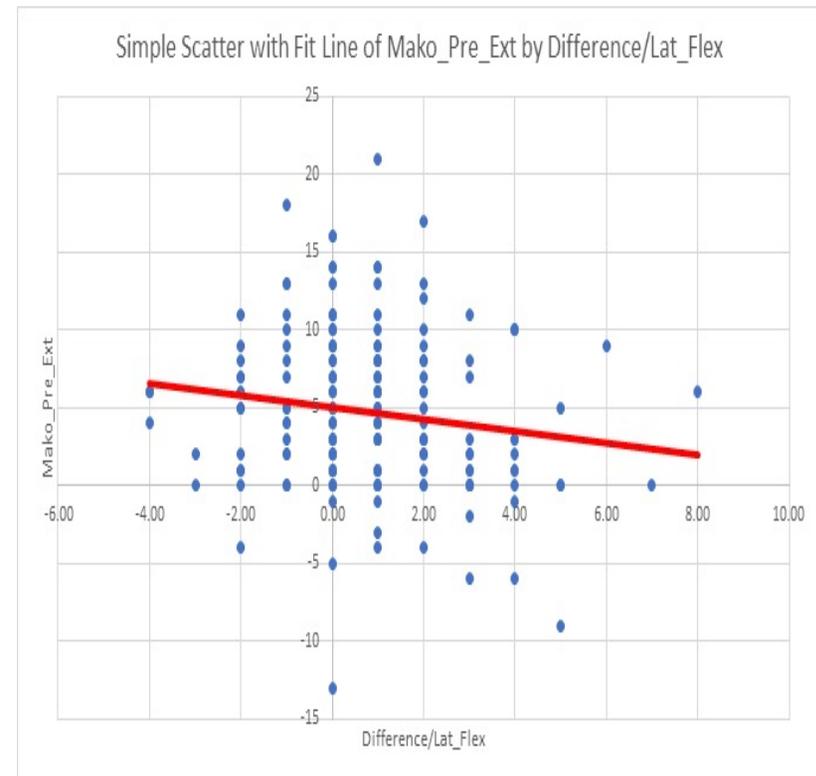
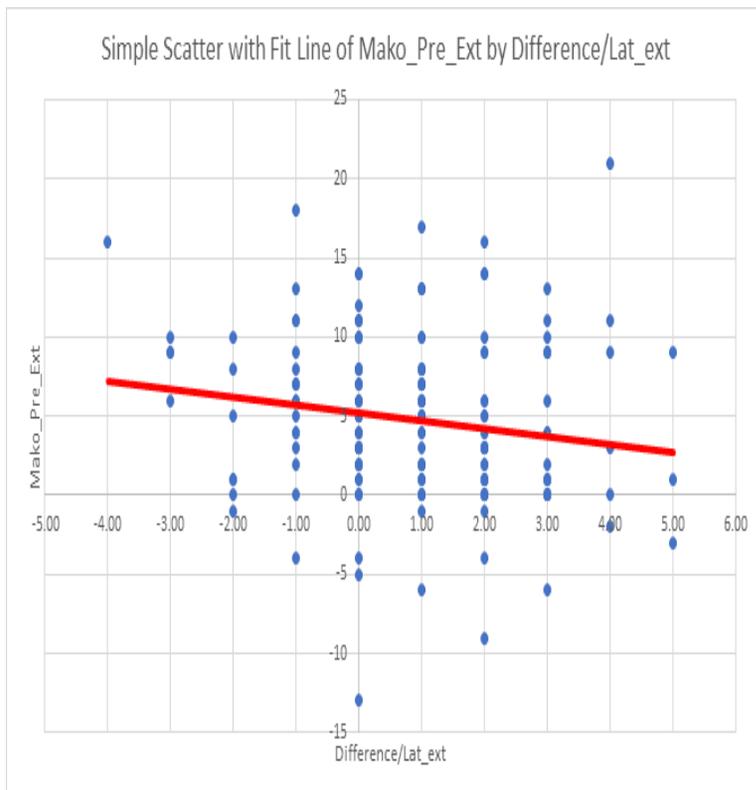
Results

- Presence and location of combined osteophytes were not associated with an increase in gap change in any plane

Dependent Variable:	<u>medial</u> extension	Lateral extension	<u>medial</u> Flexion	Lateral Flexion
Osteophyte Groups	<u>p</u> -value	<u>p</u> -value	<u>p</u> -value	<u>p</u> -value
<u>medial</u> + lateral	0.332	0.436	0.390	0.506
<u>medial</u> + tibial	0.999	0.817	0.867	0.170
<u>lateral</u> + tibial	0.165	0.754	0.327	0.115
Medial + Lateral + <u>tibial</u>	0.600	0.739	0.653	0.961

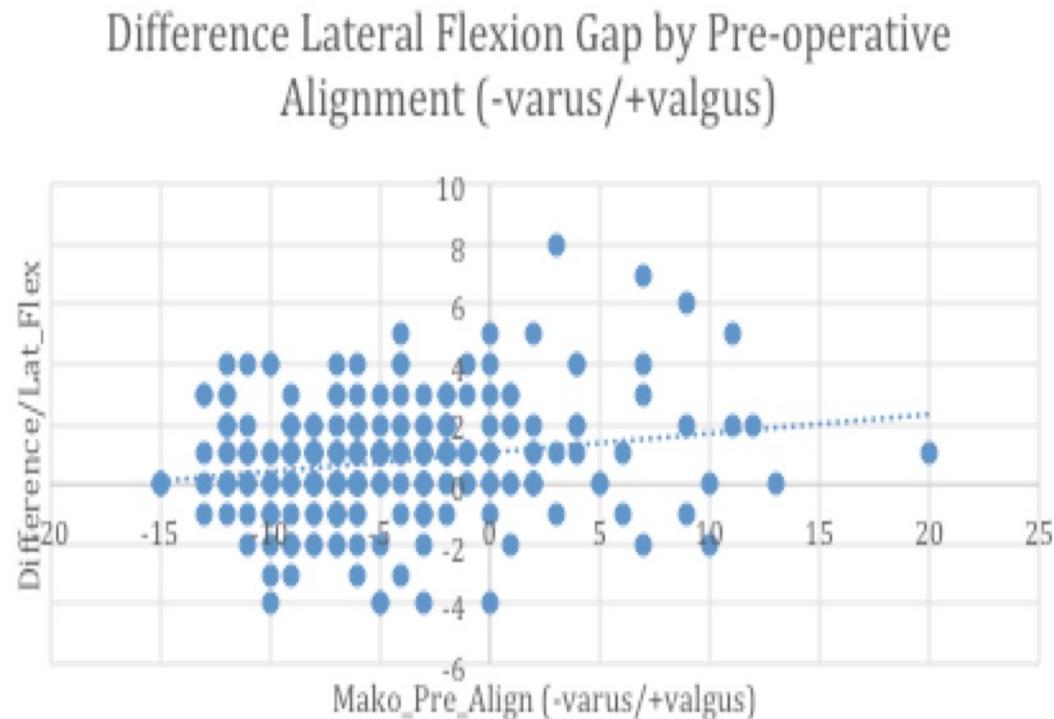
Results: Affect of Pre-Operative ROM

- Negative correlation between pre-operative extension and difference in lateral extension and flexion gaps in patients who had osteophytes



Results: Affect of Pre-Operative Alignment

- Increased pre-operative valgus alignment had a positive correlation to increase lateral flexion gap



Discussion

- Contrary to traditional gap balancing technique-our studies would suggest that we may be able to ignore small (<10mm) posterior osteophytes for most total knees in the initial steps of gap balancing

Discussion

- The lateral flexion and extension gaps change were found to be negatively correlated to pre-operative extension
 - In further analysis these patients had a higher probability to have varus deformity
 - Suggesting already increasing laxity of (stretched) lateral soft tissues and ultimately decreased gap change

Discussion

- Increased valgus alignment had a greater increase in lateral flexion gap
 - Likely result of posterolateral osteophytes, which are more difficult to remove
 - Once bony cuts are made this likely resulted in a more substantial increase in the lateral flexion gaps
 - Increased lateral flexion gap may be desirable anyway

Conclusion

- There is a small change between all gaps at pose-capture and trialing in cases with or without osteophytes

Conclusion

- Our study is unable to substantiate that change in gaps are solely due to the presence, size, or location of posterior osteophytes

Conclusion

- After removal medial or lateral osteophytes with initial exposure, you may be able to ignore posterior osteophytes (<10mm) at the initial steps of gap balancing

Conclusion

- All posterior osteophytes still need to be removed after bone cuts, so as to not limit knee extension
- Further studies need to be performed evaluating larger number of cases with osteophytes >10mm to determine if they remain insignificant

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