RADIAL SHOCK WAVE THERAPY TO TREAT PAIN ASSOCIATED WITH UNILATERAL COMPARTMENTAL OSTEOARTHRITIS OF THE KNEE AS AN ADJUNCT TO BIOMECHANICAL UNLOADING OF THE KNEE USING THE UNLOADER KNEE BRACE.

DR NICK BODEN MALAYSIA
<table>
<thead>
<tr>
<th>Ethnic groups</th>
<th>Percentage</th>
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</thead>
<tbody>
<tr>
<td>Malay</td>
<td>50.4%</td>
</tr>
<tr>
<td>Chinese</td>
<td>23.7%</td>
</tr>
<tr>
<td>Indian</td>
<td>7.1%</td>
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<tr>
<td>Indigenous</td>
<td>11.0%</td>
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<tr>
<td>Other [2]</td>
<td>7.8%</td>
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</tbody>
</table>
OSTEOARTHRITIS IN MALAYSIA

• Knee Osteoarthritis has been extensively studied in Malaysia using the Community Oriented Program for the Control of Rheumatic Diseases (COPCORD) protocol initiated by ILAR and the WHO.

• Knee pain is the commonest joint complaint in Malaysia, with 64.8% of all complaints pertaining to joints, with half of these patients showing clinical signs of osteoarthritis. (1)

• This incidence of knee complaints also rises with age for the group above 65 years of age. (1)

• The Malaysian COPCORD study of 2700 patients showed that the commonest functional disability was the inability to squat (3.1% of all respondents), which is relevant and important in the Asian context where household tasks and toileting require this posture (1)

• Racial demographics showed knee OA prevalence as follows: Indian women 5.6%, Malay Women 3.2%, Indian men 2.6%, Malay men 1.6%, Chinese women 1.1% and Chinese Men 1.3%. (1)
REASONS FOR PREVALENCE AMONGST HOUSEWIVES

• Household tasks
• Ergonomics
• Lack of exercise outside the house
• Psychosocial stresses
• Socioeconomic reasons
• Knee OA is a lifestyle disease
Measurement of health-related quality of life (HRQOL) among patients with osteoarthritis (OA) helps the health care provider to understand the impact of the disease in the patients' own perspective and make health services more patient-centered. (2)

A cross-sectional study involving 151 patients with symptomatic knee OA attending two different health clinics in Hulu Langat, Selangor, Malaysia.

The medical outcome study 36-item short form (SF-36) was used to measure the HRQOL.

Conclusion: The elderly, patients with BMI>30 and women have the highest impact of quality of life due to knee OA.

"This study showed that family physicians should try to improve the physical health of patients with knee OA, with particular care for elderly and female patients, and to help relieve the pain in patients with higher BMI." (2)
IS KNEE OA BEING TREATED PROPERLY BY PHYSICIANS IN MALAYSIA?

• 2008 study by Arshad et.al into the treatment of knee OA in a primary care setting.

• Method: A cross-sectional survey of 200 randomly selected general practitioners (GPs) in the peninsular states of Malaysia was undertaken using a questionnaire. The GPs involved were asked about basic knowledge of OA in terms of diagnosis, investigation, and treatment. They were also asked about their usage of conventional and complementary medication.
Pharmacological treatment of knee OA

- NSAIDS: 61%
- Analgesics: 35%
- Combo: 4%
Non-pharmaceutical treatment of Knee OA

Adapted from (3)
CONCLUSION

The data suggest that in the primary care setting, the majority of GPs over-investigate the diagnosis of OA. Pharmacological interventions largely concentrate on analgesics and NSAIDs. The use of physiotherapy and non-drug approaches were significantly under-utilized. There is a need to further educate GPs in the management of knee OA. (3)
KNEE OA

- Degenerative Joint Disease
  - Injury
  - Joint overuse
  - Aging
- Mechanical deterioration
  - Mal-alignment focuses weight on one area of the knee
  - Weight
- Activity level
• The most prominent macroscopic changes in cartilage with advancing OA are softening (chondromalacia), fibrillation and erosions (ulceration).

• Microscopic changes include degenerative changes and attempts at repair including cartilage cleft cells, loss of metachromasia, chondrocyte cell death, chondrocyte cloning and duplication of the tidemark.

• Biochemically, there is decreased proteoglycan content and altered proteoglycan structure resulting in profound changes in the hydration profile of the cartilage, and a decrease in hydrostatic pressure of the cartilage.

• Eventually there is collagen network disruption resulting in a decrease in tensile stiffness and strength of the cartilage. This mechanical stress gives rise to an inflammatory cascade with the expression of certain inflammatory cytokines such IL-1 and tumor necrosis factor. Certain of these cytokines have an anabolic effect on chondrocytes which are the central players in the spectrum of changes that occur in OA of the knee. (4)
MECHANICAL EFFECTS OF KNEE OA

- Gradual wearing away of the cartilage surface results in damage to the articular or meniscal cartilage, reducing the protective padding over the joints. This results in mechanical contact between bones and a wearing down of the joint surface.

- During the mid-stance phase of gait in subjects with normal knees medial compressive loads increase to a range of 70-75% of the load at the knee secondary to the addiction moment occurring at mid stance (5). This results in a higher incidence of medial vs lateral compartment OA.
GRADE 2 RADIOGRAPHIC EVIDENCE (KELLGREN AND LAWRENCE)

- Joint space narrowing (7)
GRADE 3 RADIOGRAPHIC EVIDENCE (KELLGREN AND LAWRENCE)

- Narrowing of joint space
- Subchondral sclerosis
GRADE 4 RADIOGRAPHIC EVIDENCE

- Narrowing of Joint Space
- Subchondral formation
- Osteophytes (7)
SYMPTOMS OF KNEE OA

- Pain
- Stiffness
- Difficulty squatting
- Difficulty climbing stairs
- Difficulty standing/walking
CURRENT PROTOCOLS OF TREATMENT OF KNEE PAIN (6)
CURRENT TREATMENTS (6)

- Arthroscopic
  - Lavage
  - Menisectomy
  - Debridement
  - Joint Resurfacing

- Corrective
  - HTO (High-Tibial Osteotomy)
  - DFO (Distal-Femoral Osteotomy)
  - Allograft
  - Meniscal Transplant

- Invasive
  - Arthroplasty
  - Hemi-Arthroplasty
CURRENT TREATMENTS

• 93.5% treated with pharmaceuticals or untreated
  • Control inflammation and pain
  • Secondary symptoms
  • Continued progression of disease

• 6% realignment surgery (TKA, HTO)
  • Not long term solution

• 0.5% bracing
  • Non-invasive conservative realignment therapy
  • Can delay or prevent surgery
  • Uncomfortable and bulky

• Extracorporeal Shockwave Therapy??
TREATMENT GOALS

- Reduce Symptoms
- Increase Joint Movement
- Lessen joint-damaging effects
- Promote successful outcomes
UNLOADER KNEE BRACING (6)

- **Mechanism of action**

- Medial unloader places a valgus moment about the knee for medial compartment OA vice versa

- The brace is made of hinge components which create an angulation that induces a bending moment at the hinge

- This produces a valgus/varus alignment greater than that of the lower-limb alignment

- A series of straps produce a 3 point contact bending system creating a medially/laterally directed force resulting in a valgus/varus moment depending on the desired force.

**FIGURE 1** The valgus brace produces medially directed force to the lateral aspect of the knee joint and laterally directed forces to the medial aspects proximally and distally from the joint.
MECHANICAL EFFECTS

- Reduction of compartments loads
- Reduction of adduction movements
- Decreases pain
- Increase function (8)
CLINICAL PROOF(8)

• Update results as at April 2010 from New York academy of sciences:

  • Significant improvement in disability using womac scores (medial 16 points, lateral 8 points)

  • At 6 months a significant percentage of patients reported a reduction in medication use

    • 27% reduction in pain medication

    • 33% reduction in OTC NSAIDS

    • 35% reduction in prescription NSAIDS
CLINICAL PROOF (10)

- 46 patients (17 female, 29 male) Median age 61
- 14 lateral, 32 medial unloader
- WOMAC score significantly improved in both groups
  - medial 12 pts, lateral 9 points
  - Greatest improvement from pre-brace to 6 weeks and sustained at 6 months
- 24% reduced OTC NSAIDS
- 16% reduced prescription NSAIDS
OUR PROTOCOL

• We used radial extracorporeal shockwave therapy to treat the pain associated with knee OA while patients awaited the arrival of the brace (5 weeks) and/or in conjunction with brace wearing and rehabilitation.

• Most pain related to OA knee appeared to be over the medial or lateral joint line.

• This may be due to bone bruising and due to the chronic inflammation at the site of bony contact and degeneration.
STUDY

• Pre-Bracing group, RESWT only (mixture of VAS and Womac scores), at treatment one and at treatment 5

• Post-bracing group, Bracing plus continued REWST (VAS only), at bracing and average 4.1 months in brace with average 8.1 treatments
DIAGNOSIS

• Based on history of knee pain

• All patients had standing x-rays taken to confirm the diagnosis, assess the grade/severity of OA and rule out any other pathology

• Patients with tumour/infection, inflammatory arthritis or fracture were excluded from the study.
XRAY EXAMPLES
• 4 different clinics

• 10 patients assessed

• Scores taken at start of R-ESWT and at commencement of bracing

• Average number of treatments 4.2 one week apart

• 2000 shocks per treatment

• Treatment applied at maximum point of tenderness
• Average improvement as a percentage in Womac scores 38.2%

• Average improvement in VAS scores 57.5%

• No adverse reactions

• No worsening

• Every patient improved.
WOMAC/VAS RESWT ONLY

before

after

Patient Number

1 2 3 4 5 6 7 8 9 10
DATA: SHOCKWAVE AND BRACING

- 9 patients
- Average age: 56.8
- Average number of treatments 8.1
- Average time in brace 4.6 months
- Average Womac score 11.8
- Average Vas improvement 51%
VAS SCORES AFTER RESWT AND BRACING

- **before**
- **after**

![Graph showing VAS scores before and after treatment with RESWT and bracing. The vertical axis represents the score, ranging from 0 to 8. The horizontal axis represents the VAS categories, from 1 to 9. The graph indicates a significant reduction in VAS scores post-treatment.]
MECHANISM OF ACTION OF RESWT IN KNEE PAIN ASSOCIATED WITH OA

• Pain mediating effect on substance P

• Gate Control theory

• Removal of chronic inflammation (neurogenic inflammation)

• Effect on bone bruising
Extracorporeal Shockwave Shows Regression of Osteoarthritis of the Knee in Rats.

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Abstract

BACKGROUND: This study investigated the effects of extracorporeal shockwave technology (ESWT) in osteoarthritis of the knee in rats.

MATERIALS AND METHODS: Thirty-six Sprague-Dawley rats were randomly divided into three groups with 12 rats in each group. Group I was the control group and received neither anterior cruciate ligament transection (ACLT) nor ESWT. In groups II and III, ACLT was performed in left knee and osteoarthritis (OA) was verified at 12 wk. Group II received no ESWT, and group III received ESWT at 12 wk after ACLT. Radiographs and bone mineral density (BMD) were obtained at 0, 12, and 24 wk. The animals were sacrificed at 24 wk. One half of the animals were subjected to bone strength test, and the other half for histomorphologic examination and immunohistochemical analysis.

RESULTS: Radiographs of the left knee showed progressive OA changes at 12 and 24 wk in group II, whereas, very subtle OA changes were noted in group I and group III. BMD and bone strength were significantly lower in group II compared with groups I and III, but no difference was noted between group I and group III. The cartilage degradation was significantly higher in group II compared with groups I and III, but no difference was noted between group I and group III. The subchondral bone remodeling was significantly less pronounced in group II compared with groups I and III, but no difference was noted between group I and group III.

CONCLUSIONS: Application of ESWT to the subchondral bone of the medial tibia condyle showed regression of osteoarthritis of the knees in rats.

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PMID: 20851422 [PubMed - as supplied by publisher]

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CONCLUSION

• Radial extracorporeal shockwave therapy appears to show promise in the treatment of knee pain associated with Osteoarthritis and more research with proper controls and outcome measures needs to be done.

• This improvement is sustained after biomechanical bracing using the unloader knee brace

• Radial shockwave should be considered as a mainline treatment for knee pain related to OA.

• Actual effects on cartilage/bone i.e “Shockwave Surgery” needs to be investigated further to assess if regression of Osteoarthritis may be a possibility in the future.

REFERENCES


6. Ossur Academy presentation


Terima Kasih