

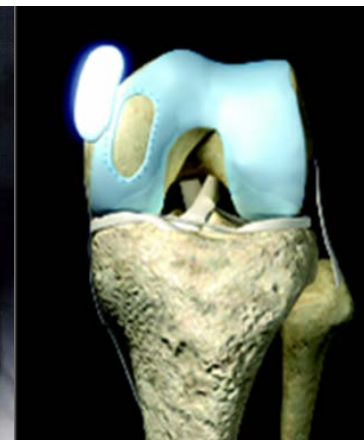
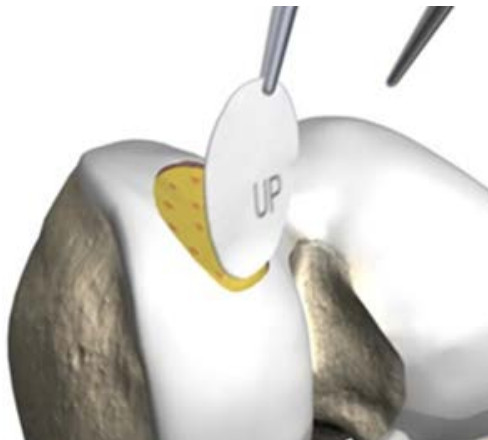


HA Convention



2018 Hospital Authority Convention
醫院管理局研討大會
7-8.5.2018 Hong Kong Convention & Exhibition Centre
香港會議展覽中心

Cost Effectiveness of Cartilage Repair Surgery for Treatment of Cartilage Defects of the Knee in Hong Kong



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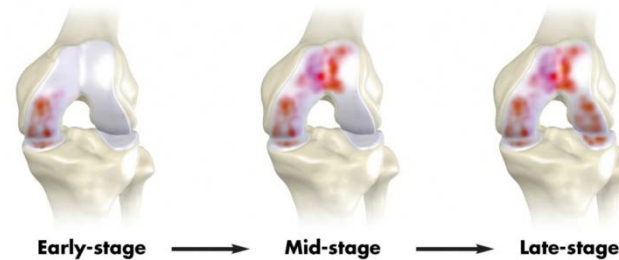
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2018 醫院管理局研討大會





Objective



- To estimate the **Cost effectiveness** of **Regenerative Cartilage Repair procedures** in the public health service of Hong Kong, under the Hospital Authority, by investigating the costs and health status effectiveness of Microfracture, ACI and AMIC in treating symptomatic **articular cartilage defects of the knee.**





Introduction



- **Articular cartilage lesions are common**



- *Curl & Poehling et al, Arthroscopy 1997;13(4):456*
- Cartilage Injuries : A Review of 31516 knee arthroscopies
- 63% had different degrees of chondral lesion
- 20% full thickness exposing bone; 5% pts < 40 y.o.

- **Cartilage “repair” techniques available**

- Marrow Stimulation Techniques(MST)e.g. Microfracture
- Osteochondral Autograft Transfer (OAT)
- Autologous Matrix Induced Chondrogenesis (AMIC)
- Autologous Chondrocyte Transplantation (ACI)



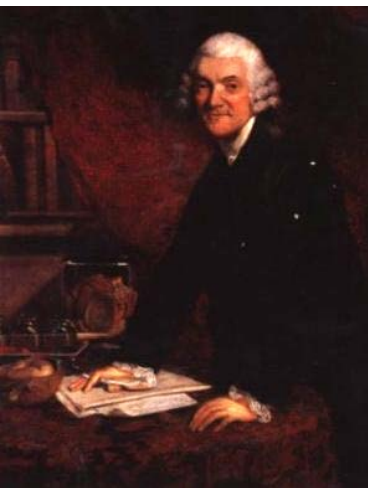


CHONDRAL LESIONS

Limited potential
to heal



**NEED TO “REGENERATE”
ARTICULAR CARTILAGE**

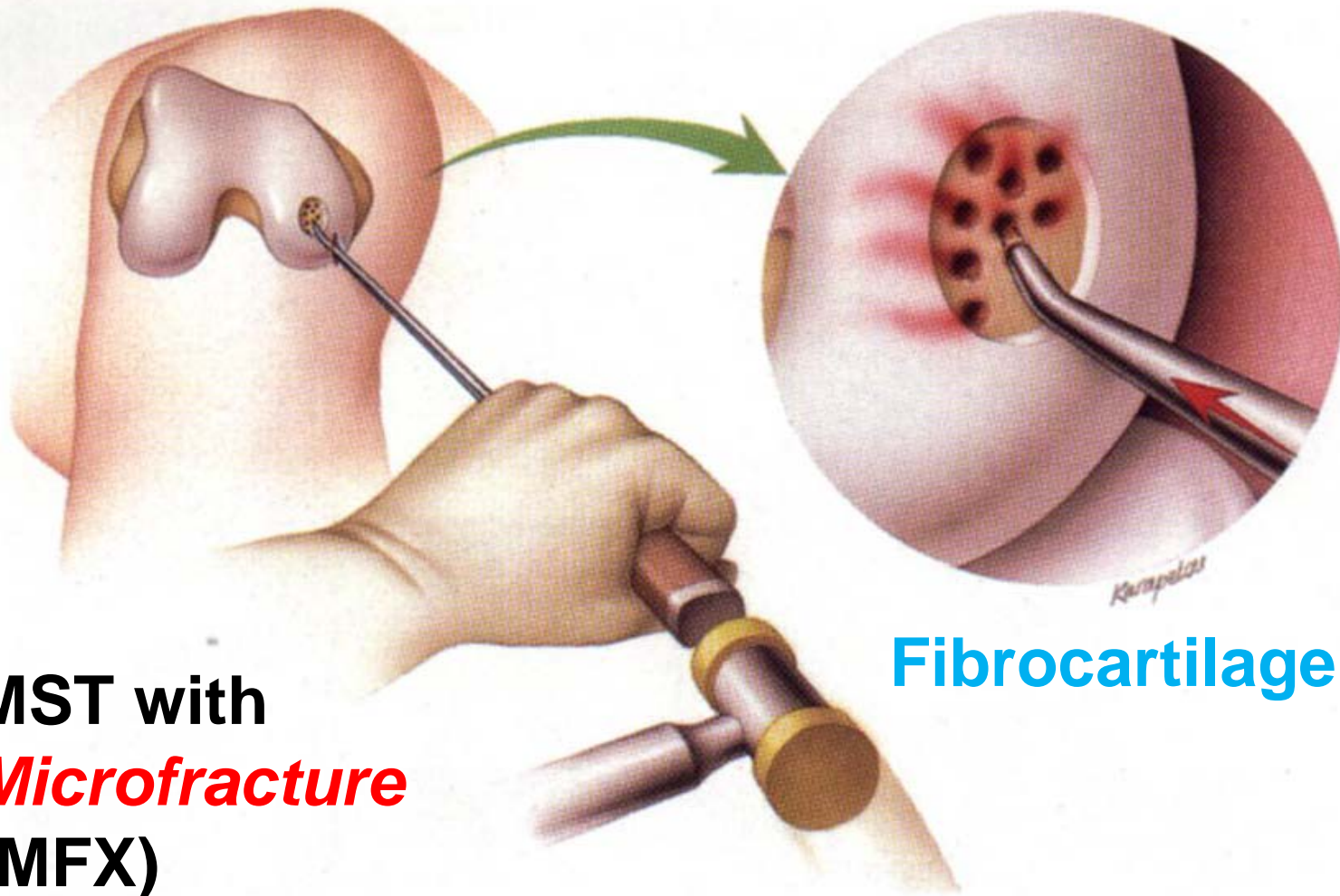


Premature
osteoarthritis



Joint replacement fails
in young patients





MST with
Microfracture
(MFX)

Fibrocartilage





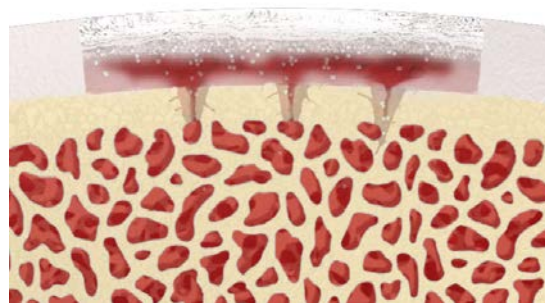
AMIC : Autologous Matrix Induced Chondrogenesis

5. Cartilage defect covered with Collagen matrix / Hydrogel

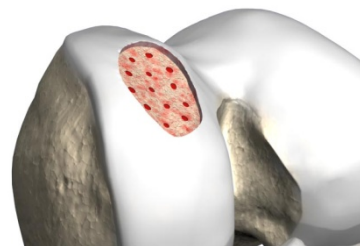
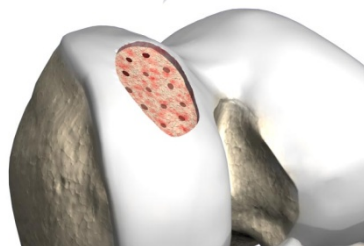
1. Size the Defect



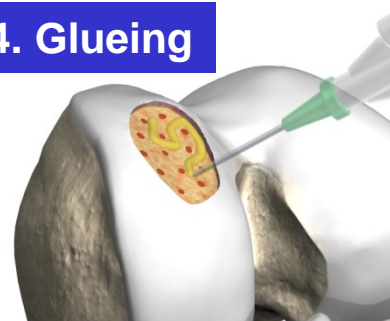
2. Prepare the Collagen matrix



3. Microfracturing

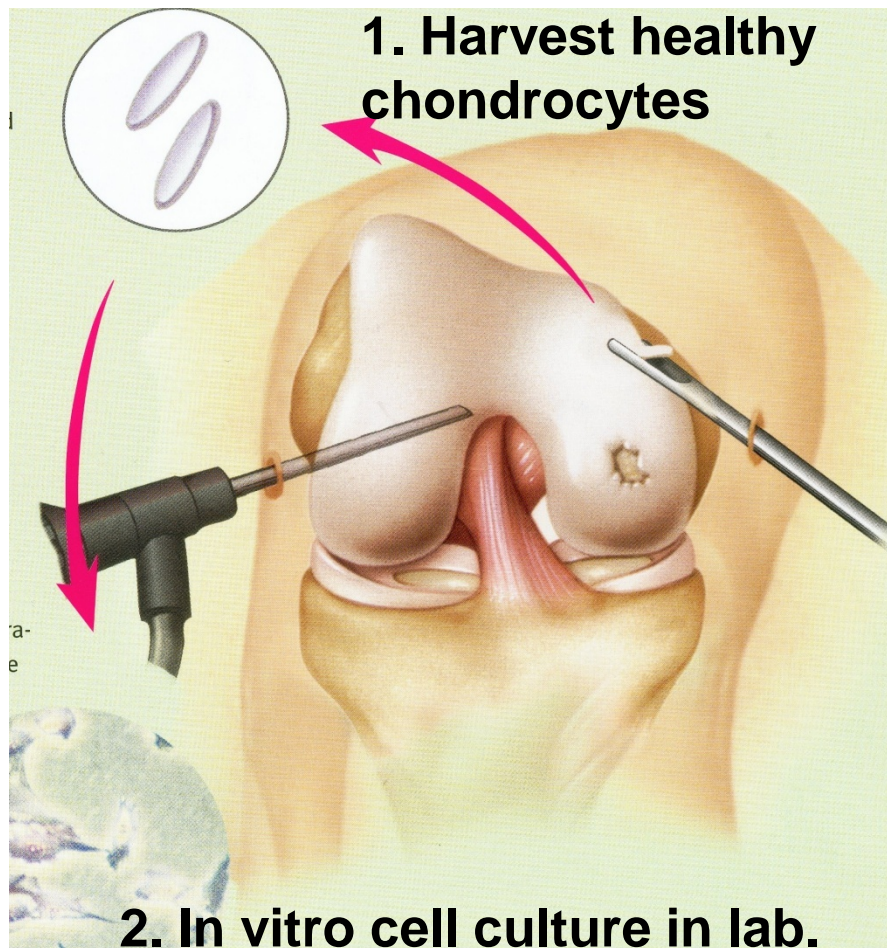


4. Glueing





ACI : Autologous Chondrocyte Implantation





Background

- New “regenerative” techniques are costly (far more **expensive** than MFX)
- Lack of **health status effectiveness** data (clinical & QOL improvement)
- Absence of **Cost effectiveness & Cost utility** data in Hong Kong



HEALTH ECONOMICS





Methodology



- An economic model was constructed in Microsoft Excel®, with patients undergoing either **MFX, AMIC, or ACI**.
- Clinical effectiveness was measured by functional scores (**KOOS & WOMAC**), the latter consisting of 3 subscales: Pain, Stiffness, and Physical Function
- Quality of Life (QOL) was gauged by 12-Item Short-Form Health Survey (**SF-12**), which includes 2 aggregate measures, the physical and mental components, derived from 8 subscales
- Utility was first measured by changes in **SF-6D** scores, which were converted into **utility scores**.

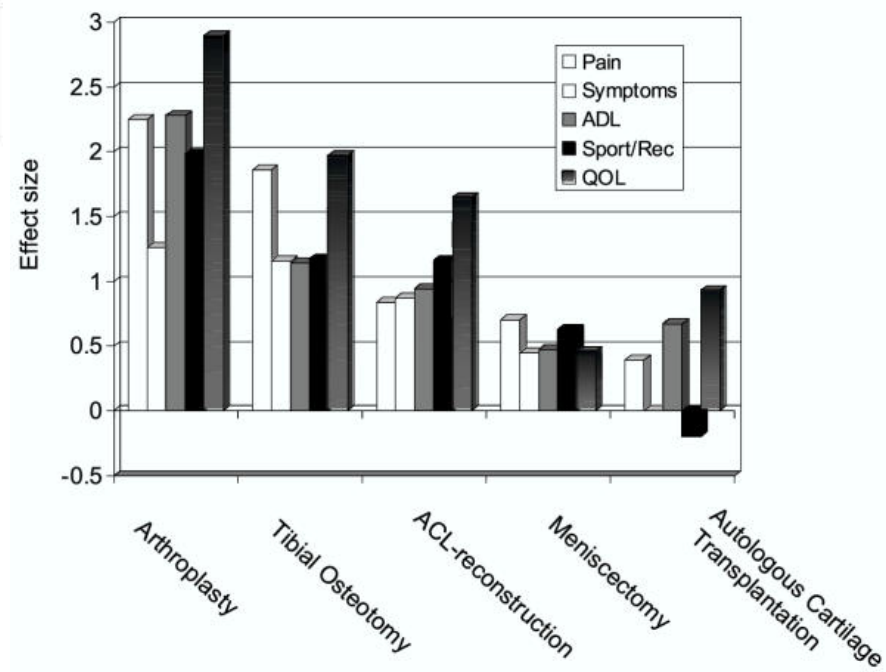
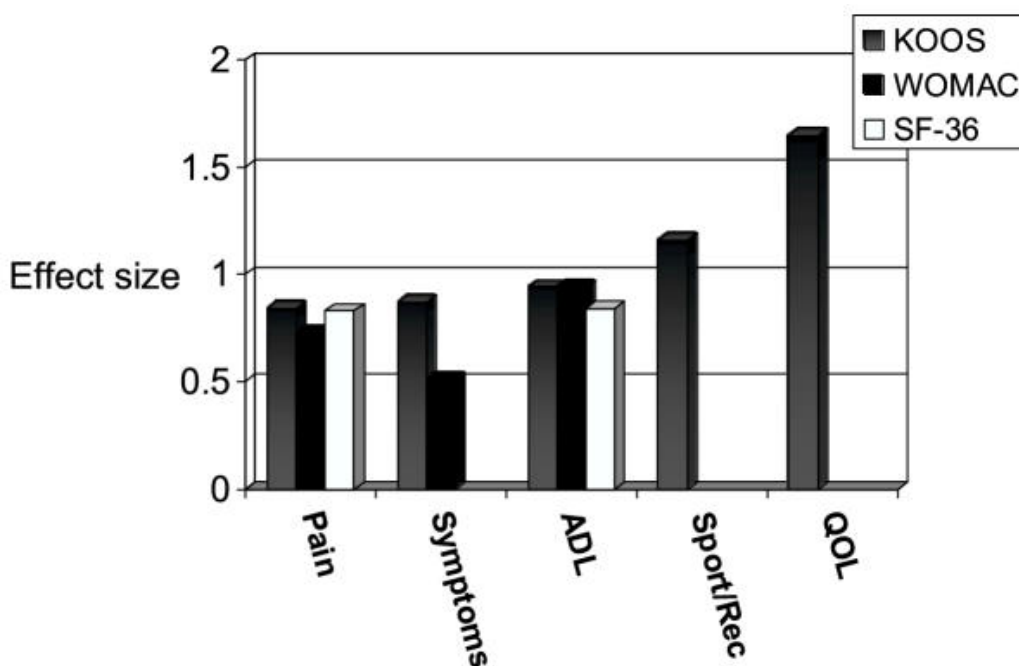


Review

Open Access

The Knee injury and Osteoarthritis Outcome Score (KOOS): from joint injury to osteoarthritis

Ewa M Roos^{*1,2} and L Stefan Lohmander¹





Methodology



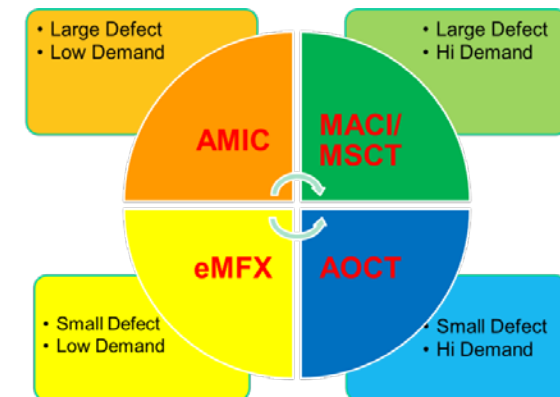
- **Adverse results**
 - Complications or serious clinical events
 - Treatment failure and ultimately converted to total knee replacement
- **The mean **per-patient costs** associated with MFX, AMIC, and ACI were determined**
 - From HA publication on gazetted charges, and price quotation of the implant/instrument vendors.
 - The cost for each procedure was then divided by the weighted mean difference in functional outcome score to give the cost-per-point change in outcome score, or **ICER**.
- **QOL Results were expressed in quality-adjusted life-years (QALYs) and Hong Kong Dollars.**
- **Both costs & outcomes were discounted at 3.5 % per year.**





Materials

- ALL patients who received MFX, MACI or AMIC at QEH between 2001 and 2015. (Min. FU = 24 months)
 - Total 70 patients
 - 40 MFX (27M:13F), aged 33-73 (mean 52.6)
 - Mean Size 2.83cm²; Avg. Tegner Scale 5.2
 - 10 ACI (7M:3F), aged 23-49 (mean 36.3)
 - Mean Size 2.66cm²; Avg. Tegner Scale 7.2
 - 20 AMIC (16M:4F), aged 28 To 65 (mean 48.9)
 - Mean Size 2.47cm²; Avg. Tegner Scale 6.7
 - Most (65.7%) have concomitant procedures
 - ACLR, ALRR, AMR/APM, HTO, ARLB, MP, TTO
- Correct Underlying Causes





Materials

- **ACI :**

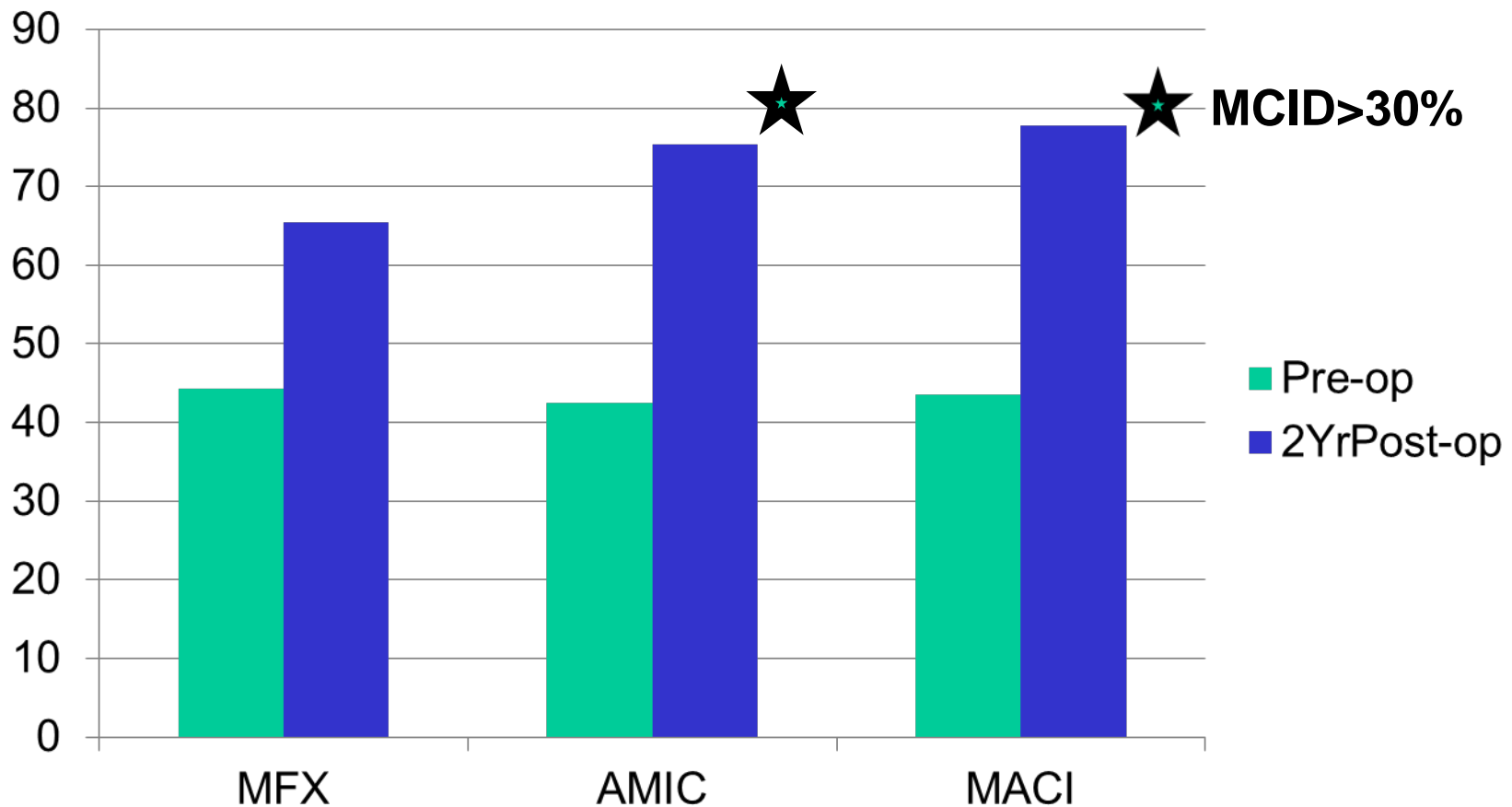


- **AMIC :**





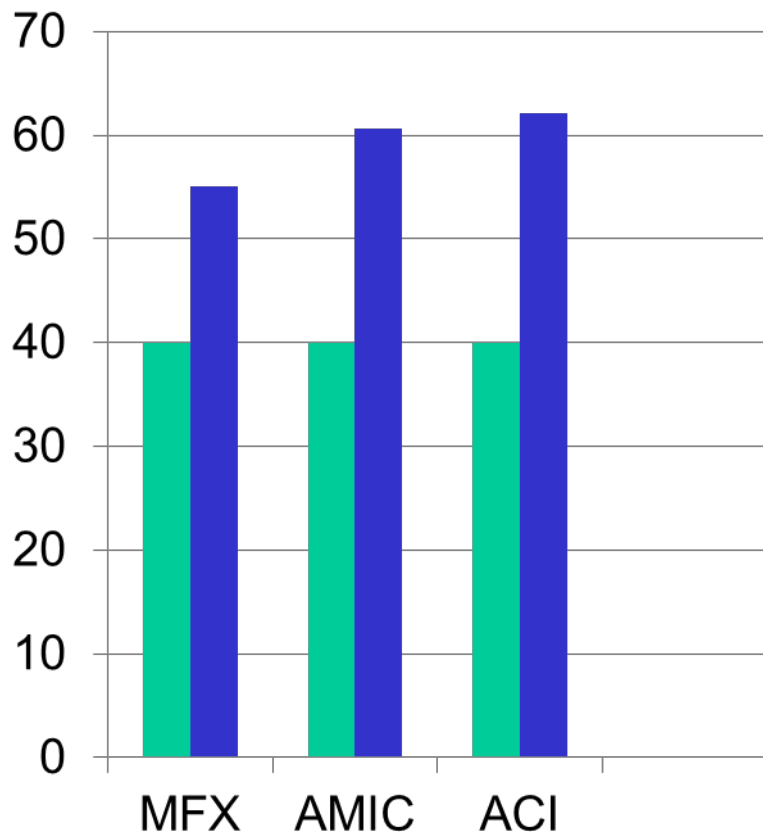
Results : KOOS



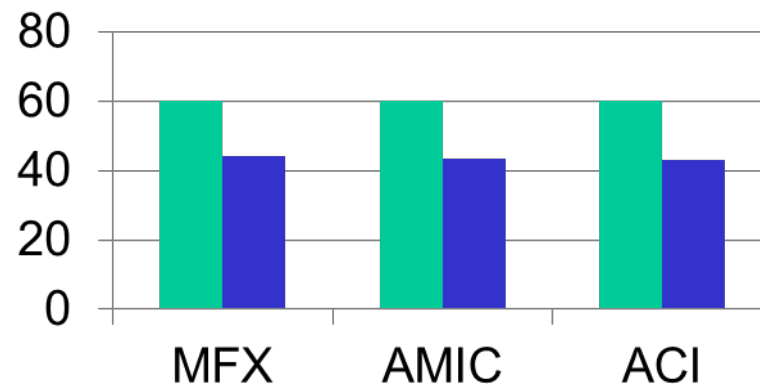


Results : WOMAC Subscales

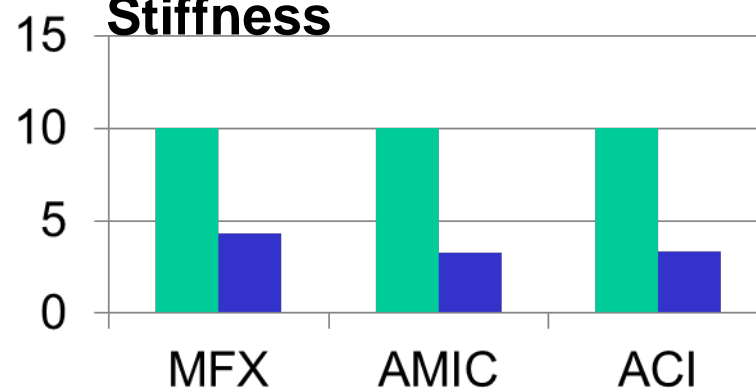
Physical function



Pain



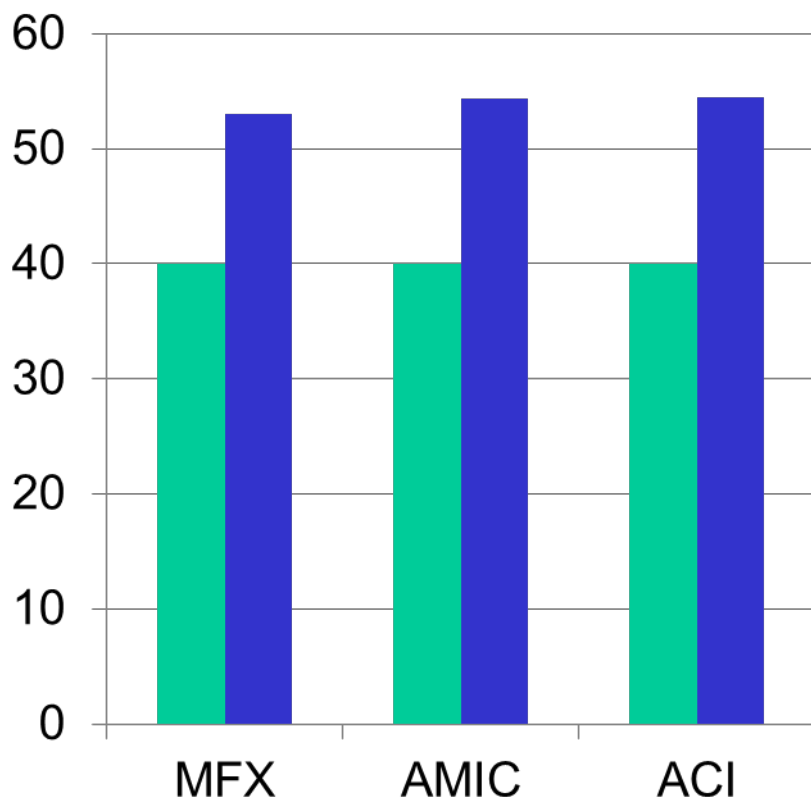
Stiffness



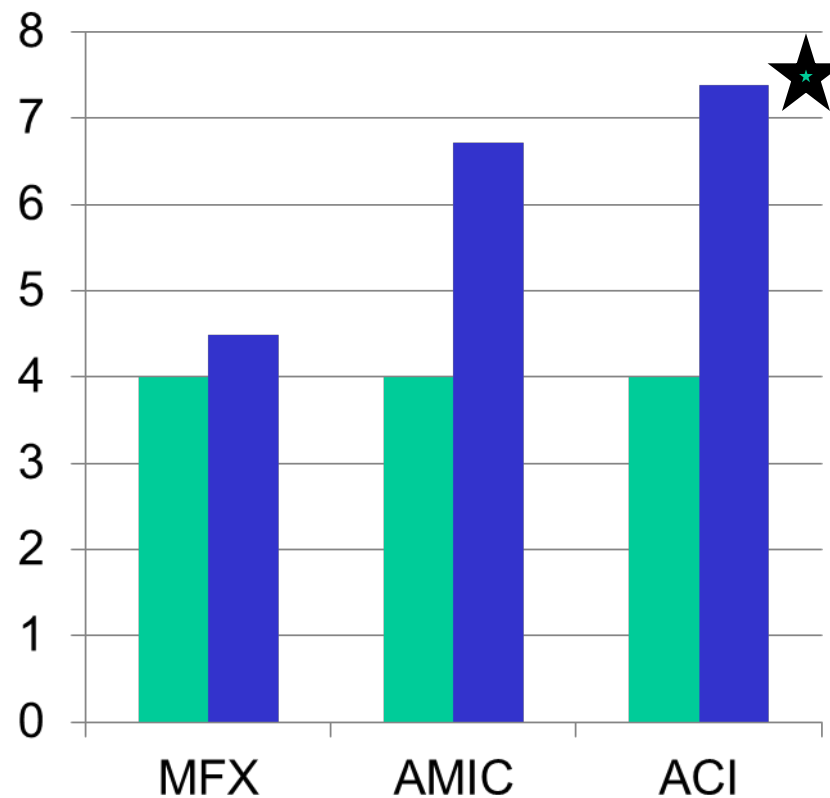


Results : SF-12

Physical component



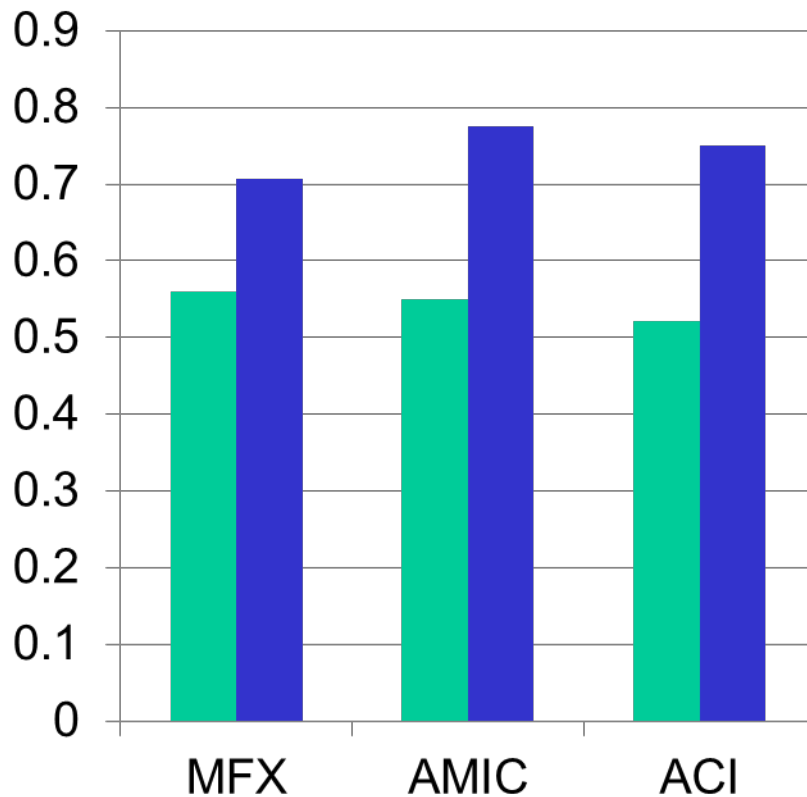
Mental component



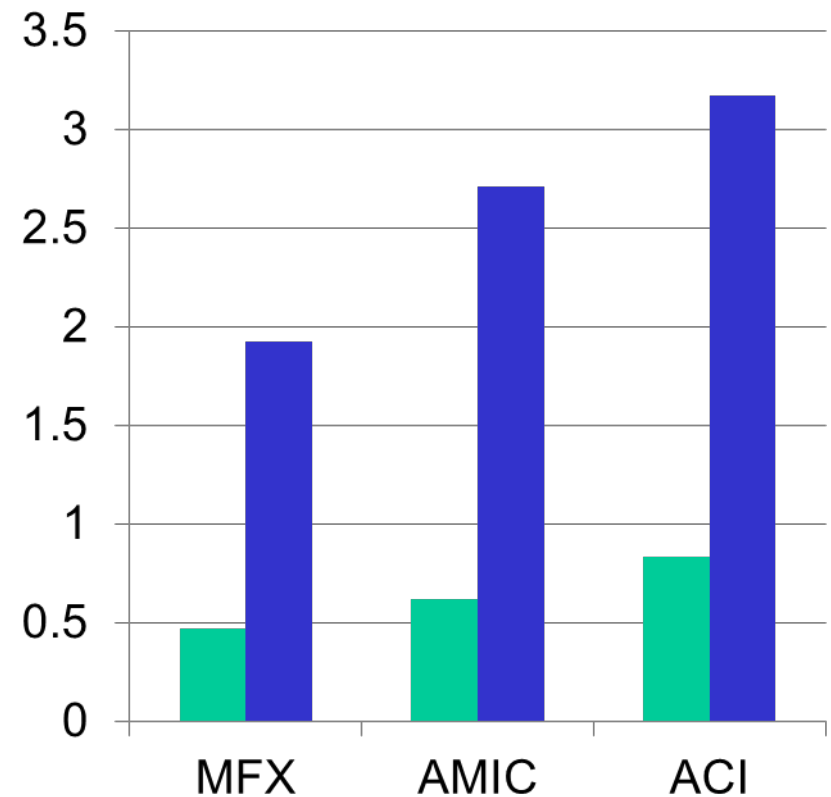


Results : Utility Scores & QALY

Utility Score from SF-6D



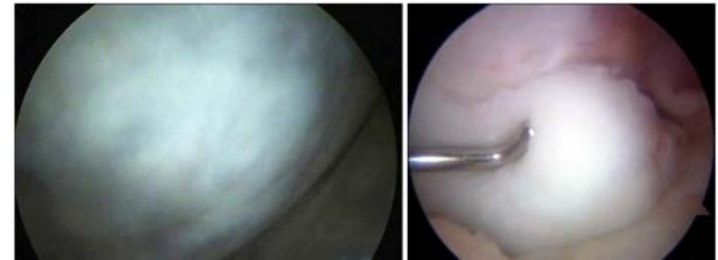
QALY gained at 2 Year & LT





Adverse Events

• Complications :



	Persistent pain	Persistent swelling	Arthrofibrosis	Graft hypertrophy
Microfracture	11 (27.5%) 9	5 (12.5%)	3 (7.5%) 2	-
AMIC	2 (10%) 1	1 (5%)	1 (5%) 1	-
ACI	1 (10%)	-	-	1 (10%) 1

Re-operation

• Conversion to TKR (Clinical Failure) :

- MFX : 8 (33.3% of 24 FU > 5 Yrs)
- ACI : 0
- AMIC: 0





Direct Medical Costs (HK \$)



- **MFX**

- 1D hospital: 36900
- Consumable: 1220
- Total: **38,120**

- **AMIC :**

- 2D hospital: 44750
- Consumable: 22720
- Total: **67,470**

- **ACI (2-stage)**

- 1. Harvest

- 1D hospital: 36900
- Consumable: 1220
- Sub Total : 38120

- 2. Implantation

- 2D hospital: 44750
- Consumable: 104720
- Grand Total: **187,590**





Cost Effectiveness

- Incremental cost-effectiveness ratio (ICER), representing the cost-per-point change in outcome score (KOOS) :

- MFX : \$191,557.8
- AMIC : \$204,454.5
- ACI : \$543,739.1

$$\text{Incremental Cost Effectiveness Ratio (ICER)} = \frac{\text{Cost of Tx A} - \text{Cost of Tx B}}{\text{Success of Tx A} - \text{Success of Tx B}}$$

- Cost-per-QALY gained (ICUR) :

- MFX : \$81,279.3
- AMIC : \$109,707.3
- ACI : \$226,012.0

Cost Utility Ratio

$$\frac{\text{Cost}_{\text{new}}}{\text{QALYs}_{\text{new}}} - \frac{\text{Cost}_{\text{old}}}{\text{QALYs}_{\text{old}}}$$





Conclusion (Clinical Effectiveness)

- MFX, AMIC, and ACI are **all effective** surgical procedures for the treatment of cartilage defects in the knee. All 3 treatments led to an increase in functional outcome scores postoperatively with a short-term follow-up
- **AMIC and ACI**, both considered regenerative techniques, had a statistically **greater improvement** in functional and radiological outcome scores as compared with MFX. Both of them achieved **MCID>0.3**

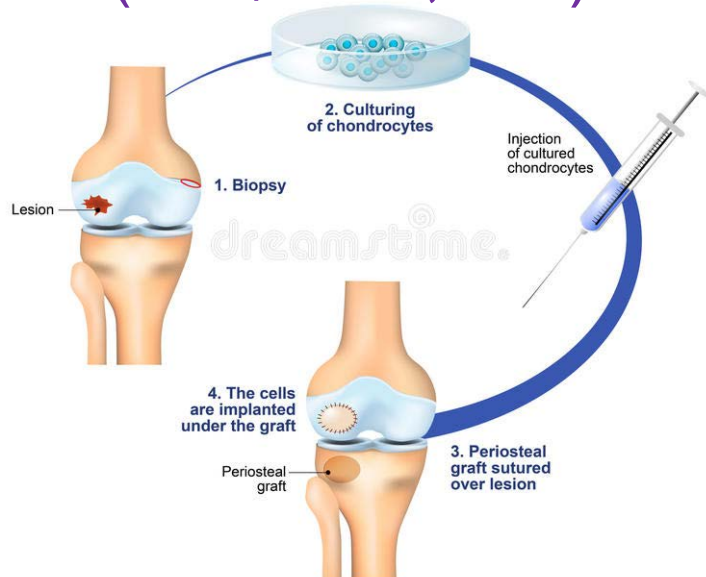




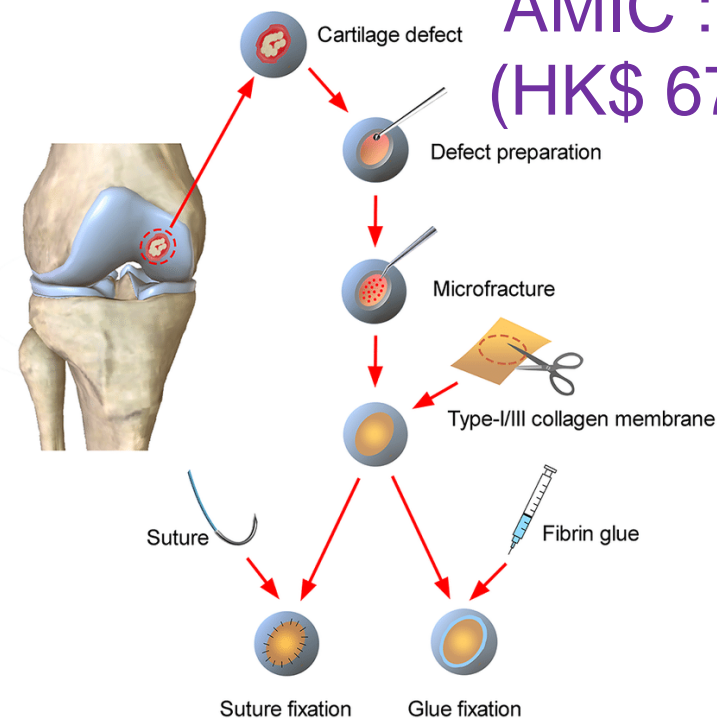
Conclusion (Cost Effectiveness)

- Our study has found **huge differences** in average cost between ACI and AMIC (both showed MCID>30%), favoring AMIC over ACI.

AUTOLOGOUS CHONDROCYTE IMPLANTATION (HK\$ 187,590)

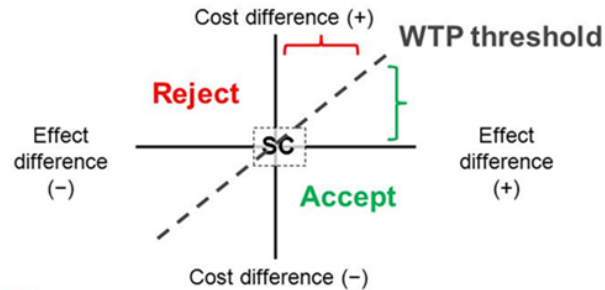


AMIC : (HK\$ 67,470)

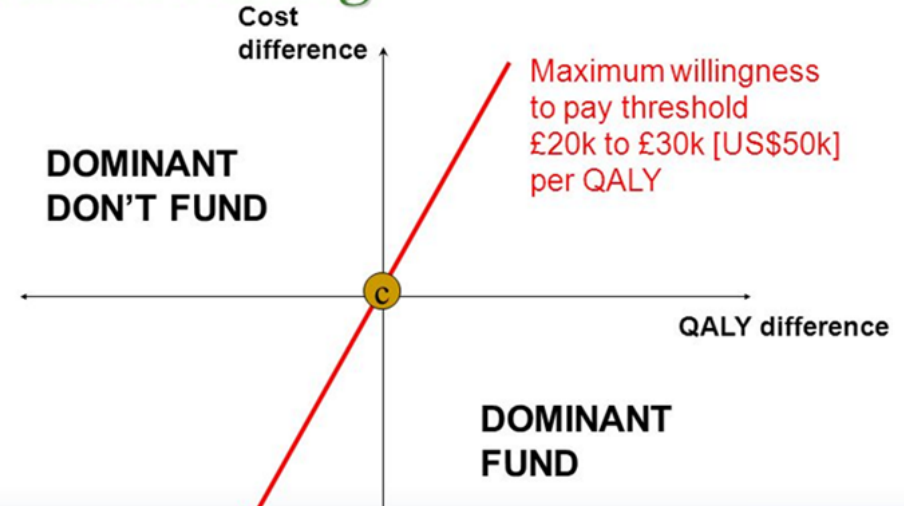


Economic analysis: “willingness to pay” threshold

- Some countries/health care systems use an official or unofficial threshold of acceptable ICERs for new technology assessments



CEA Rationale Framework for Decision Making

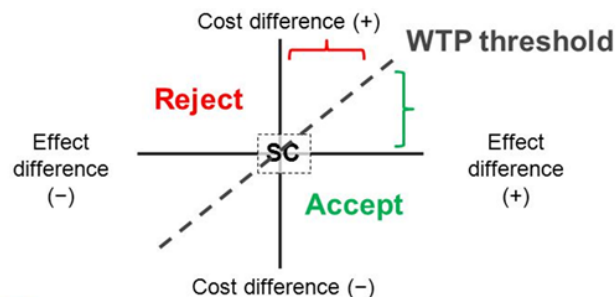


- However, when cost is considered alongside patient health status utility benefits (considering cost-per-QALY gained, reflected by WTP threshold), the difference is narrowed, & **both AMIC & ACI are still beneath US & UK funding thresholds** for new technologies

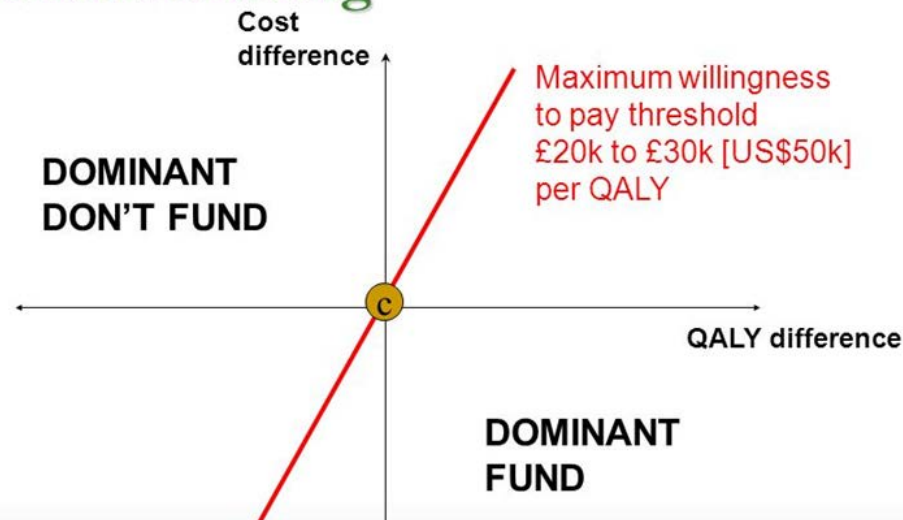


Economic analysis: “willingness to pay” threshold

- Some countries/health care systems use an official or unofficial threshold of acceptable ICERs for new technology assessments



CEA Rationale Framework for Decision Making



- US & UK funding thresholds for new technologies (approx. HK\$390K & HK\$360K respectively)
- Our study has confirmed that both the cell-based (HK\$226K) & non-cell-based (HK\$109.7K) techniques for cartilage regeneration result in clinically-effective & cost-effective improvements in health status.





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