# TENS, Electroacupuncture and Ice Massage: Comparison of Treatment for Osteoarthritis of the Knee

Merih Yurtkuran, Tuncer Kocagil

Uludag University Medical Faculty

Department of Physical Therapy and Rehabilitation, Bursa, Turkey

Medizinische Universität Graz

The Chondrocyte and Osteoarthritis (OA)
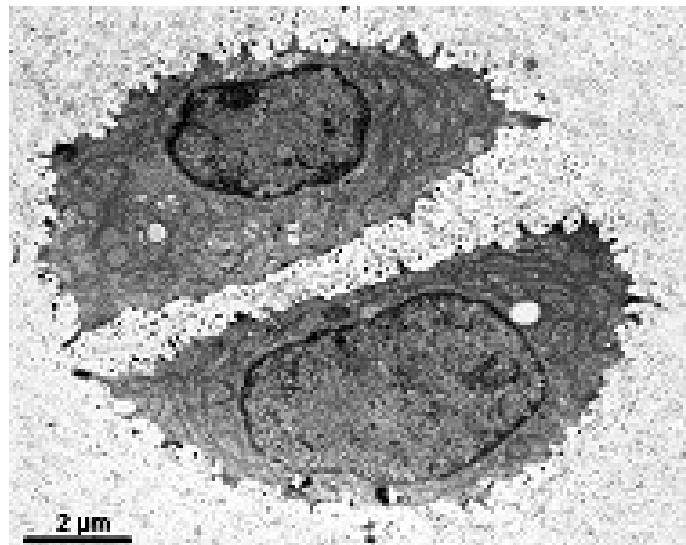

mechanical overloading

age

genetic predisposition

cartilage matrix
Synthesis

cartilage matrix
degradation
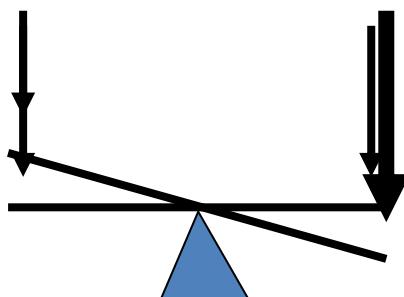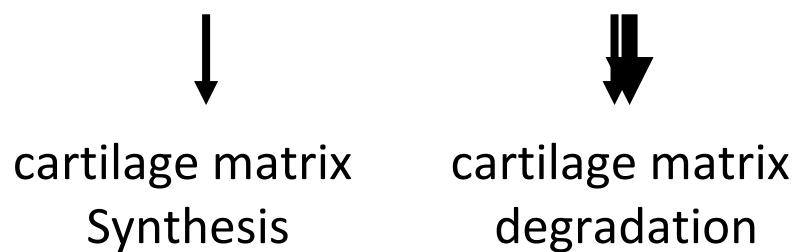
Osteoarthritis

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Osteoarthritis (OA)

- chronic, non-inflammatory joint disease, characterized by loss of articular cartilage and thickening of subchondral bone

- painful and disabling disease

- most common joint disease, 80% of elderly population affected, Austria 2009: 80.000 days of hospital care and 12.200 surgical joint replacements (knee only)

- Joint replacement therapy is the only curative therapy

- Pathogenesis unknown (IL-1, NO and degradative enzymes)

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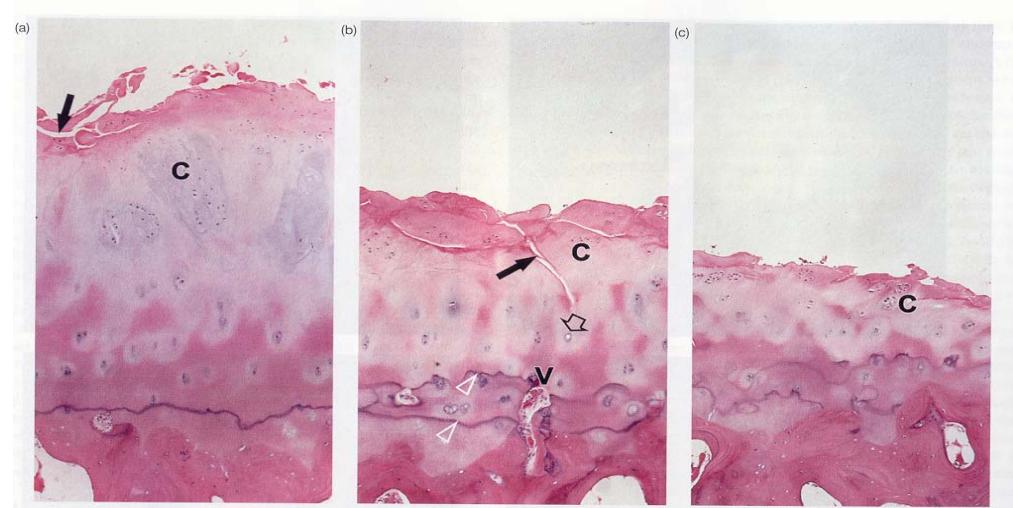
Treatment

Treatment goal is pain relief !

Routine management: analgetics and anti inflammatory drugs

→ side effects

Non-invasive treatments: (P**I**CO)

    1.) Transcutaneous electrical nerve stimulation (TENS)

    2.) Electroacupuncture (EA)

    3.) Ice massage

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Aim and Hypothesis

No comparative trials concerning the three modalities

AIM: Effects of the electrical modalities (TENS and EA) and ice massage in the treatment of knee pain due to OA.

Hypothesis: Electrical modalities and ice massage would be statistically superior to placebo.

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Methods

- randomized

- parallel

- single - blinded study (assessor)

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Participants 1 (PICO)

100 outpatients (91 female, 9 male)

divided into 4 groups (Gr1 – Gr4); 25 patients/group

Inclusion:

- duration of knee pain of 6 months or more

- osteoarthritic radiological findings

- no gross leg malalignment

- no mechanical block to knee motion

- no significant concomitant medical problem or bleeding tendency

- not undergoing any specific medical or surgical treatment or physical therapy

- no cardiac pacemaker

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Participants 2

Gender:

Group 1: 0M/25F

Group 2: 3M/22F

Group 3: 2M/23F

Group 4: 4M/21F

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Participants 3

Symptom duration:

a) = 0 – 9 years
b) = 10 – 19 years
c) = 20 – 40 years

Gr 1: a)7, b)11, c)7
Gr 2: a)15, b)8, c)2
Gr 3: a)11, b)11, c)3
Gr 4: a)9, b)10, c)6

Table 1.
Demographic data of the treatment groups

	TENS	EA	Ice massage	Placebo
Number of patients	25	25	25	25
Sex: Female	23	21	25	22
Male	2	4	-	3
Age (years) 45 - 49	7	8	5	5
50 - 59	14	15	15	16
60 - 69	3	2	5	3
70	1	-	-	-
Disease duration (years)				
0 - 9	11	9	7	15
10 - 19	11	10	11	8
20 - 40	3	6	7	2

Mean age (range): 58.1 (45-70) years old

Gr 1: (45-69) years old
Gr 2: (45-69) years old
Gr 3: (45-70) years old
Gr 4: (45-69) years old

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Interventions (PI<u>C</u>O)

<u>Gr 1:</u>

<u>Ice massage:</u> ice cubes at knee (4 acupuncture points according to chinese literature)

5 minutes each point for total of 20 minutes, 5 days per week for 2 weeks

<u>Gr 2:</u>

<u>Control:</u> placebo TENS applied on same 4 points for total of 20 minutes, 5 days per week for 2 weeks

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Interventions

Gr 3:

Acupuncture-like TENS: 4 small rubber electrode, 0.4-2.5 volt
intermittent rectangular waveform at 4Hz and 1000
microsec., current increased slowly to create muscle
contraction, just below pain treshold, 20 minutes, 5 days per
week for 2 weeks

Gr 4:

Electropuncture: stainless steel acupuncture needles inserted
to 0.5-1.0 inch depth at the same 4 acupoints , needles
connected to electrostimulator and treatment with
same parameters as acupuncture-like TENS

Outcomes (PIC<u>o</u>)

1 - Present pain intensity (PPI)(1-5 scale)

(mild: 1, moderate: 2, severe: 3, very severe: 4, excruciating: 5)

2 – Stiffness

3 – 50 foot walking time (min.)

4 – Strength - Isometric quadriceps (kg)

5 – ISOM - Knee flexion (degrees)

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Evaluation of parameters 1

Table 2.
The Evaluation of the parameters

	Pain	Stiffness	Quadriceps		
			50 foot walking time	muscle strength	knee flexion
TENS (n=25)					
Pretreatment	1.2 + 1.1	10.7 + 7.3	47.3 + 49.4	8.6 + 4.7	127.6 + 8.9
Posttreatment	0.2 + 0.5 **	2.2 + 5.2 **	19.1 + 15.7 *	13.0 + 4.4 **	130 + 7.6 **
EA (n=25)					
Pretreatment	1.36 + 0.5	8.0 + 4.3	21.9 + 4.1	8.6 + 1.6	127.6 + 7.6
Posttreatment	0 **	0.8 + 1.8 **	13.4 + 4.2 **	12.1 + 2.2 **	130.2 + 6.9 **
Ice massage (n=25)					
Pretreatment	0.7 + 0.6	7.2 + 5.4	28.4 + 6.7	7.8 + 2.6	127.2 + 7.5
Posttreatment	0.4 + 0.4 *	4.3 + 4.9 *	19.4 + 5.8 **	9.3 + 2.6 **	128.0 + 6.9 NS
Placebo (n=25)					
Pretreatment	0.7 + 0.8	7.8 + 4.2	34.7 + 3.8	7.8 + 1.4	128.1 + 7.2
Posttreatment	0.5 + 0.4 NS	7.2 + 4.1 NS	29.1 + 3.7 NS	7.0 + 1.7 NS	119.2 + 8.3 NS

$* P< 0.05$; $** P < 0.001$; NS: Not significant

Evaluation of pain, stiffness, 50 foot walking time and knee flexion degree:
All treatments more effective than placebo!

Evaluation of parameters 2

Table 3.
One-way ANOVA results for the four treatment groups

			DF		TRMS	F	P
Pain at rest	TRSS:	4.88	3		1.63	6.72	0.01
	ESS:	21.37	91	Error	0.23		
Stiffness period	TRSS:	1522.54	3		507.50	10.01	0.01
	ESS:	4663.60	92	Error	50.69		
Quad. muscle strength	TRSS:	529.13	2		176.38	16.10	0.01
	ESS:	895.70	83	Error	10.92		
50 foot walking time	TRSS:	3116.02	3		1038.67	13.62	0.01
	ESS:	6938.48	91	Error	6938.48		
Knee flexion degree	TRSS:	1651.10	3		550.33	11.95	0.01
	ESS:	4191.00	91	Error	46.05		

DF: Degrees of freedom; TRMS: Treatment mean of squares; TRSS: Treatment sum of squares;
ESS: Error sum of squares;

There were no significant differences between the three treatment results (Table 3).

Comparison of the treatment results of these modalities revealed statistically significant differences among them (Table 3).

Evaluation of parameters 2

Table 4.
Changes in the parameters produced by the treatment and placebo
(percent improvement)

| | Pain at rest (PPI) % | Stiffness % | Quadriceps | | |
			50 foot walking time %	muscle strength %	knee flexion %
TENS	52.6	66.6	45.8	71.1	1.8
EA	96.0	76.8	36.1	41.5	1.4
Ice massage	75.0	35.4	30.3	28.2	0.7
Placebo	7.0	25.3	0	6.7	2.5

„The improvement as assessed by PPI changes clearly shows that EA was the most effective modality for pain reduction – the main symptom of OA of the knee.“

Acupuncture with low-frequency high-intenisty electrical stimulation generally involve the Endorphinergic mechanism, generate a slow-onset analgesia, have long-lasting results and a cumulative effect.

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Conclusion

To explore the differences between EA, TENS and ice massage:

- Larger
- prospective
- randomized
- and long-term studies

are needed.

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