

## Biomechanics

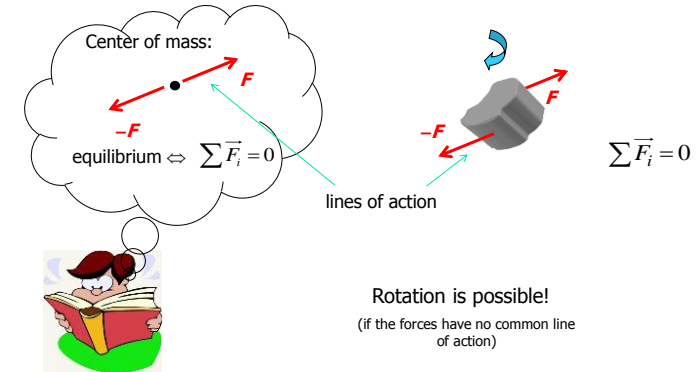


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## Statics of the rigid body

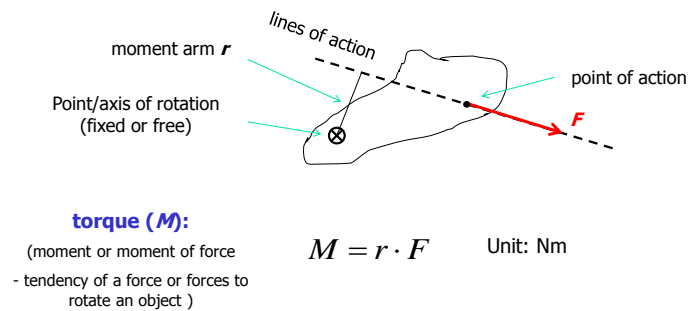
Point-like mass body:

Extended rigid body:



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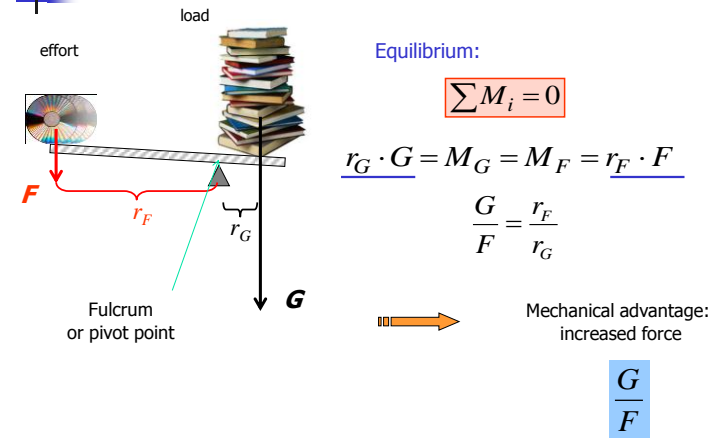
## Statics of the rigid body – torque



$$\text{equilibrium} \Leftrightarrow \sum \vec{F}_i = 0 \text{ and } \sum M_i = 0$$

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## Lever: a simple machine



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## Examples

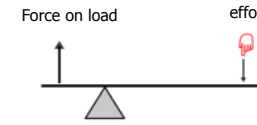


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## Types

### Class 1

Fulcrum between the effort and load.



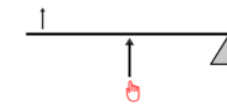
### Class 2

The effort and load on the same side.



### Class 3

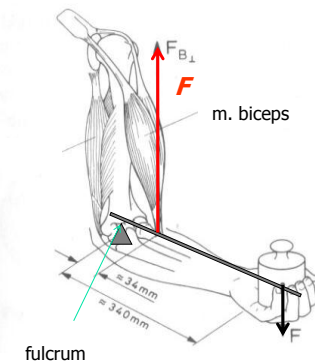
mechanical disadvantage, distance moved by the load is greater.



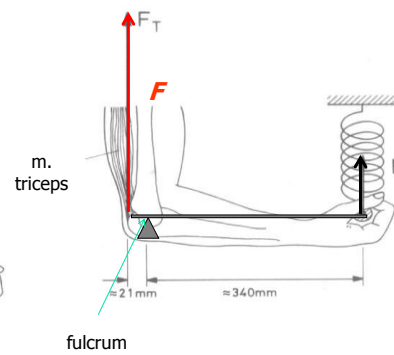
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## In the human body

Arm:



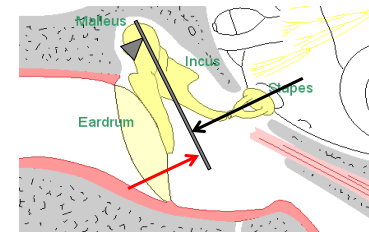
Class 3



Class 1

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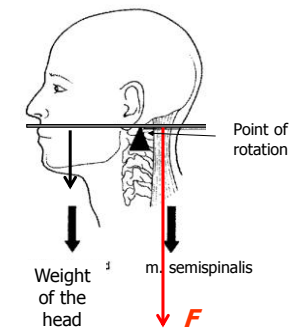
Ear bones:



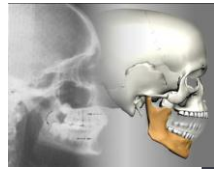
Class 2

Holding the head:

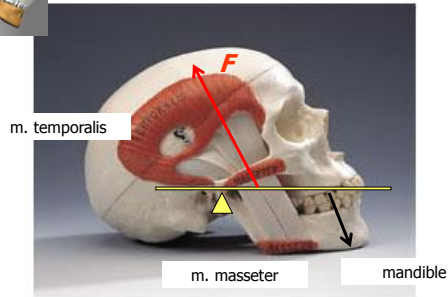
Class 1



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Class 3



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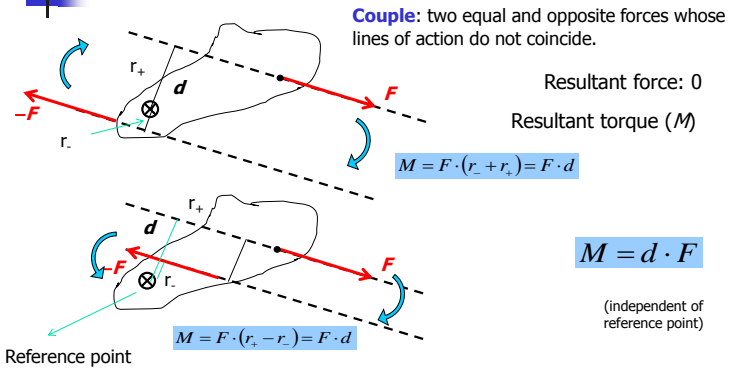
## In dentistry



Class 1

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## Couple, replacement of system of forces

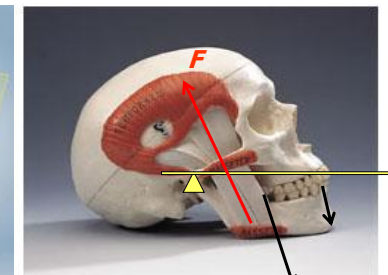


Any system of forces may be replaced by a force and a couple.

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## Masticatory force

Jaw elevators and depressors



Force system

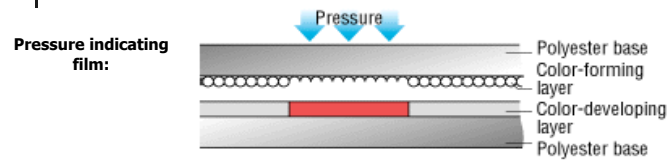


about 10 000 N

(Guinness: human - 4000 N)

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## Measurement of the masticatory force



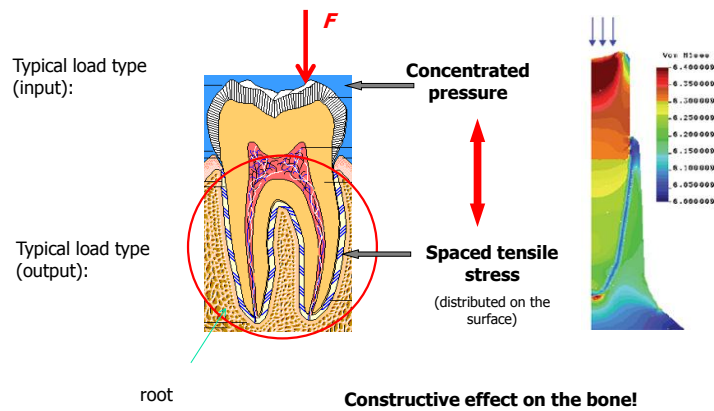
micro-encapsulated color forming and developing material

**Piezoelectric sensor:**  
(look at piezoelectric effect!)

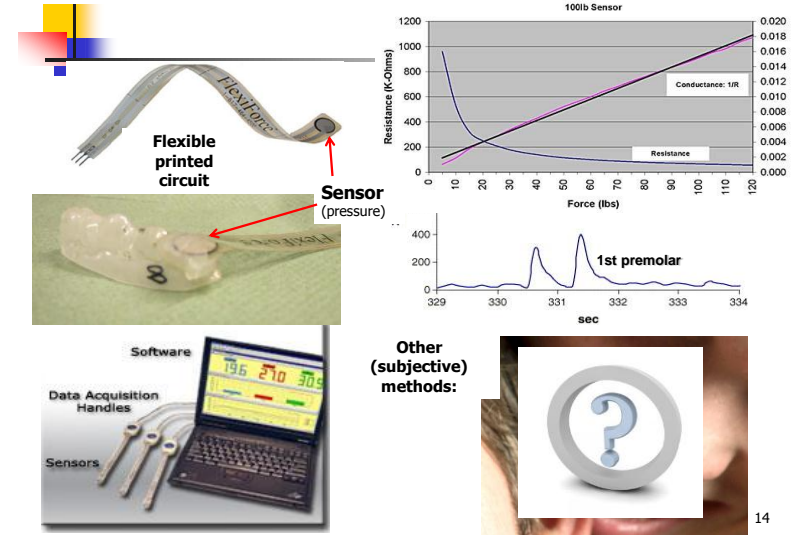


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## Transmission of forces to the bones



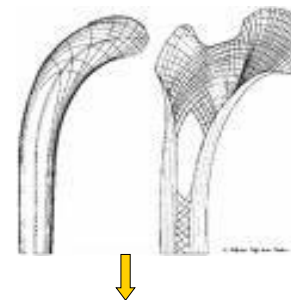
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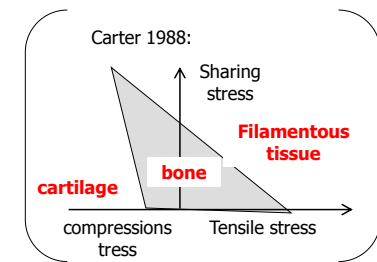
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## Bone remodeling

Wolff's law 1870: the bone in a healthy person will adapt to the loads.

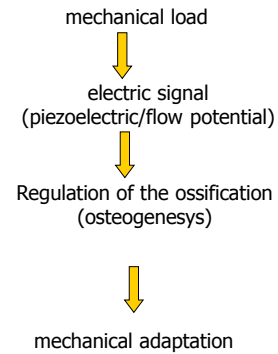


Compression stress  $\Rightarrow$  bone resorption  
Tensile stress  $\Rightarrow$  ossification

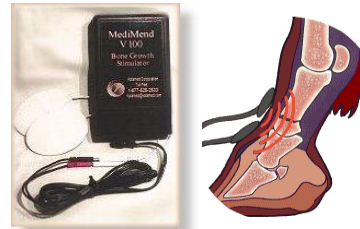


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## Mechanism of bone remodeling

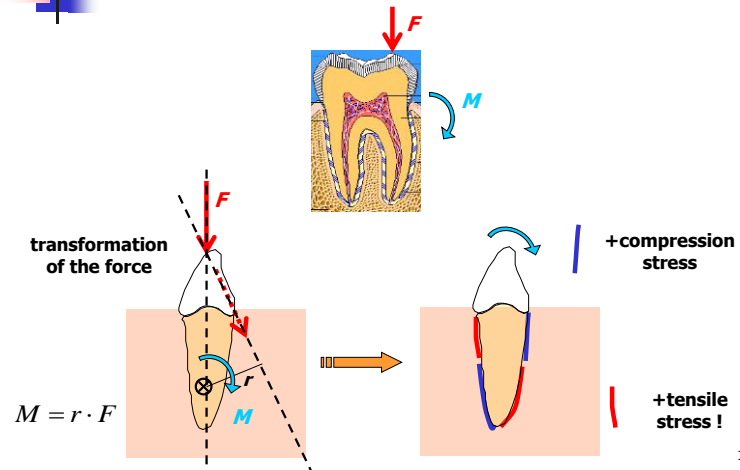


Application of electric fields in the stimulation of bone healing:



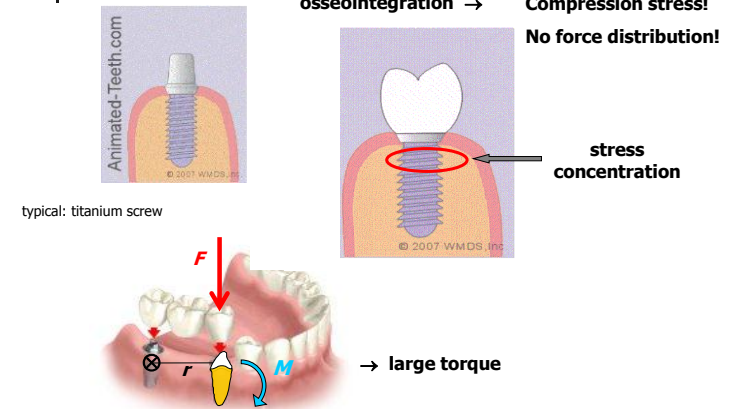
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## Torque of the masticatory forces



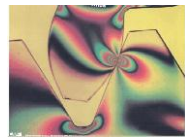
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## Force transmission of dental implant



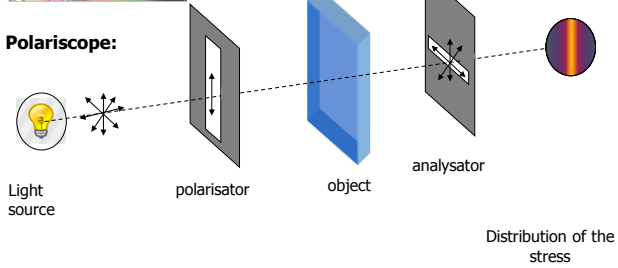
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## Physical testing methods in implantology



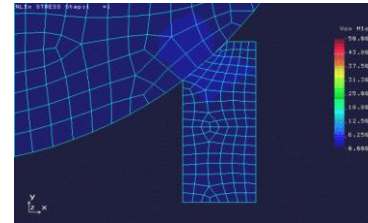
- Stress-optic method

### Polariscope:



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## Computer based method



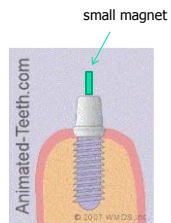
- finite element method

Calculation on a model.

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## Stability test

- **Resonance Frequency Analysis (RFA)** is a method used to determine stability in dental implants.



small magnet

magnetic pulses are applied to a small magnet and the resonance is analysed.

- **Periotest**

Electrically driven head percusses the implant and the response is monitored.



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