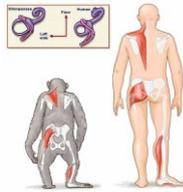




Biomechanik



Physikalische Grundlagen der zahnärztlichen Materialkunde 13.

1

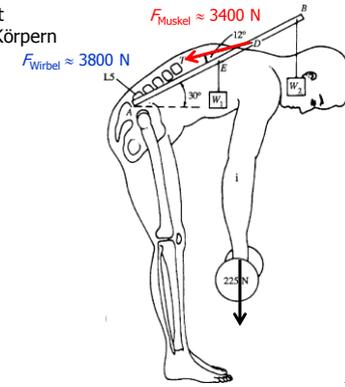
Kräfte und Drehmomente im Körper

- Äußere Kräfte:
- Schwerkraft – Gewicht
 - Kontakt mit anderen Körpern

- Innere Kräfte:
- Muskelkontraktion
 - Flüssigkeitsströmung
 - Osmotischer Druck



<http://www.motekmedical.com/products/hbm/>

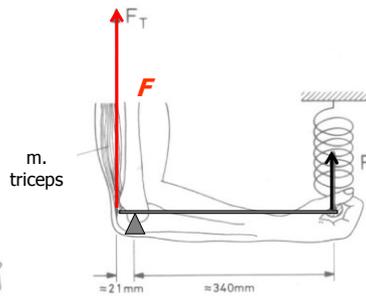
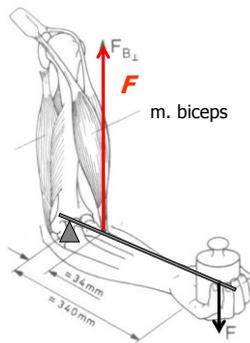


$F \approx 0 - 6000 \text{ N}$

2

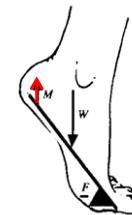
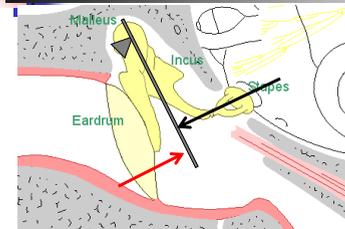
Hebel im Körper

Arm:

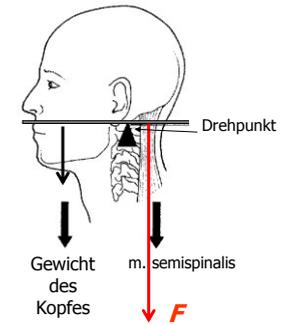


3

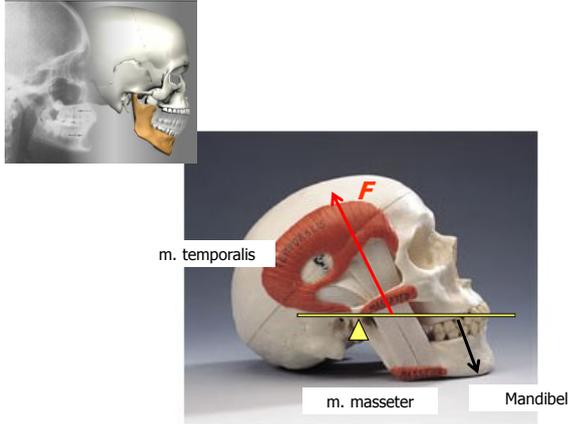
Gehörknöchelchen:



Kopfhaltung:



4

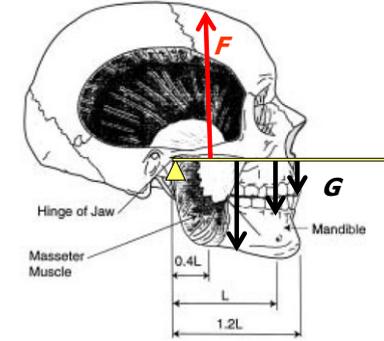
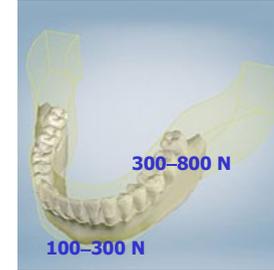


5

Kaukräfte

(Guinness: bei Mensch - 4000 N)

Cca. 10 000 N

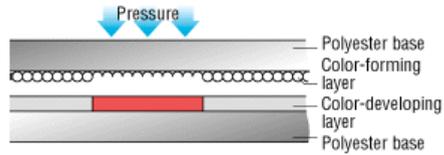


L = 8 cm (Mann)
6,5 cm (Frau)

6

Messung der Kaukräfte

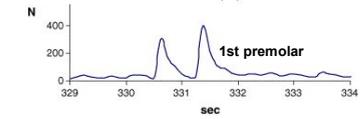
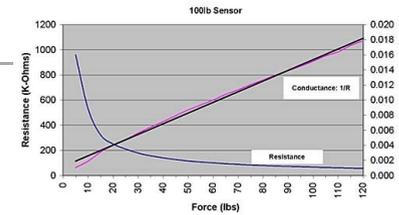
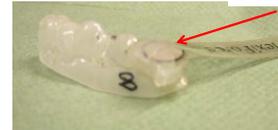
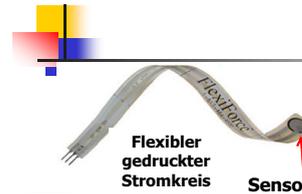
Farbstoff-Folie:



Piezoelektrischer Sensor:



7



Sonstige (subjektive) Methoden:



8

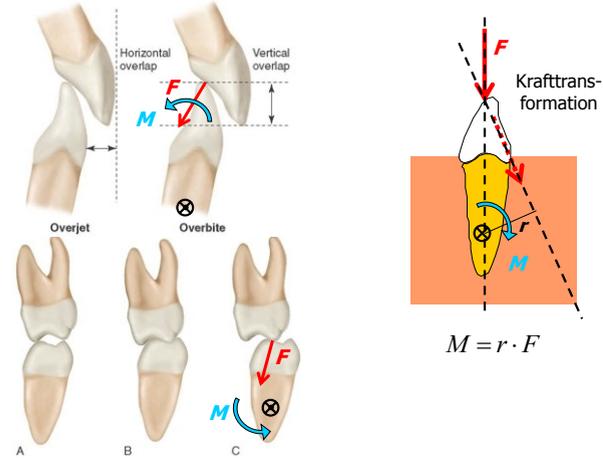
Druckwerte beim Kauen



$p \leq 300 \text{ MPa}$!

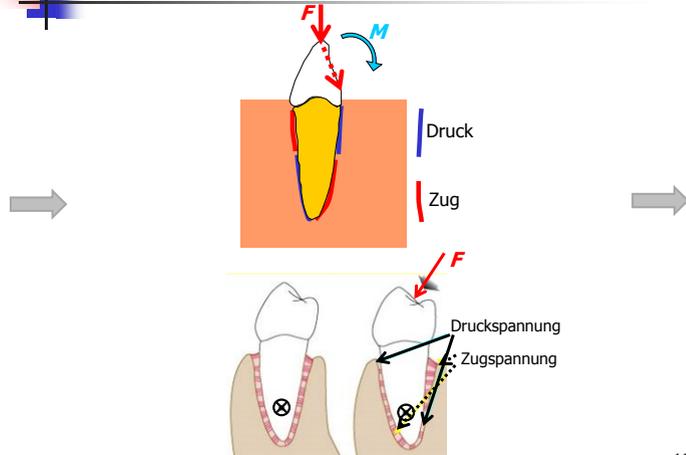
9

Drehmoment einer Kaukraft



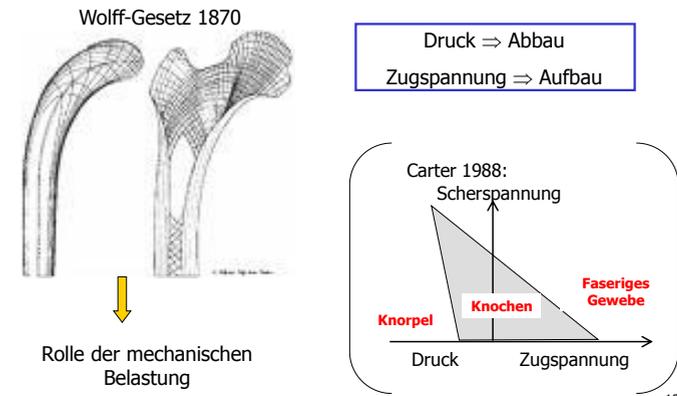
10

Folgerung des Drehmoments



11

Knochenumbau (remodeling)



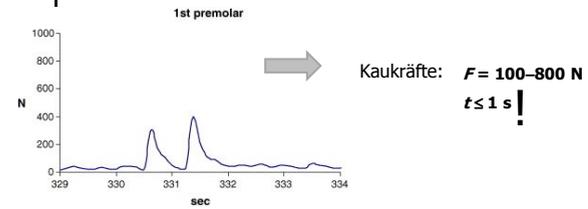
12

Mechanismus des Knochenbaus



13

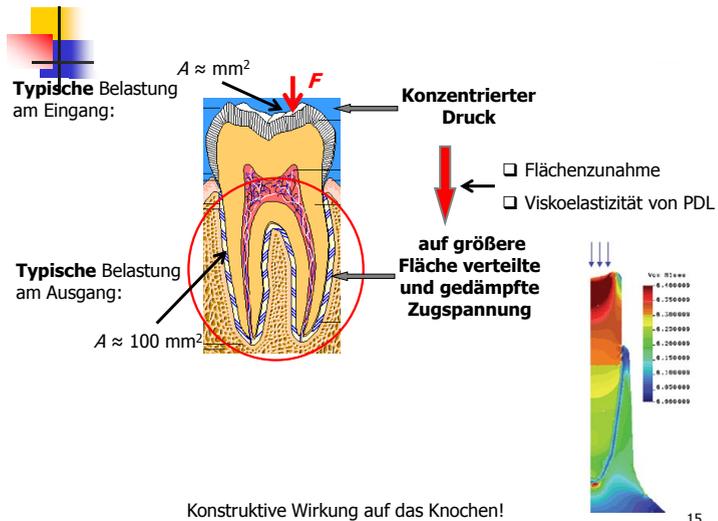
Übermittlung der Kaukräfte auf den Knochen



Wenn die Kaukräfte dauerhaft wirken würden:

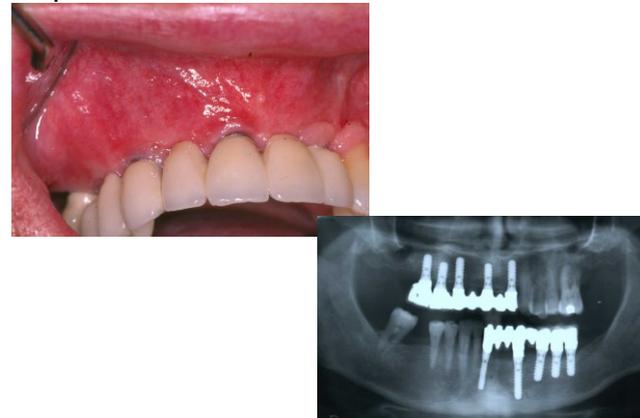
- 3-5 Sekunden \Rightarrow Schmerz
- \approx Stunde \Rightarrow Schädigung
- 7-14 Tage \Rightarrow Lockerung des Zahnes

14



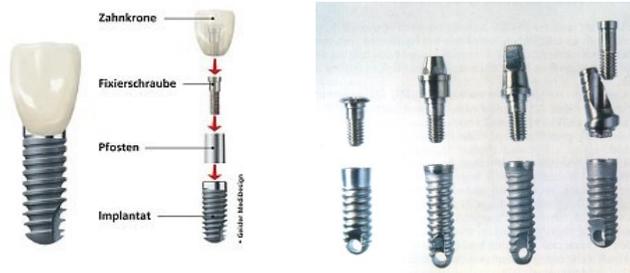
15

Grundlagen der Implantologie



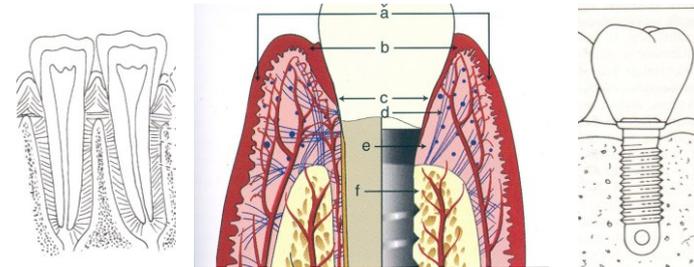
16

Schraubenimplantate



17

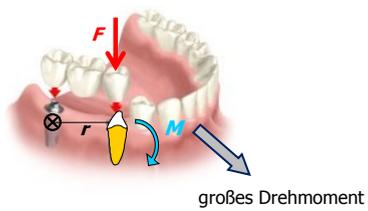
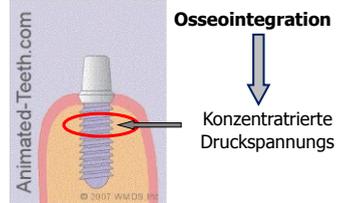
Natürlicher Zahn vs. Implantat



18

Kraftübermittlung von Implantaten

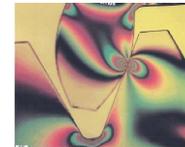
Kraftübermittlung von Implantaten:



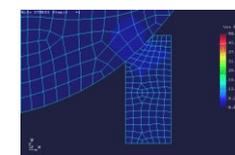
19

Untersuchungsmethoden der Spannungsverteilung

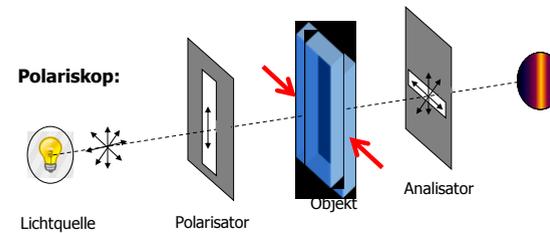
• Spannungsoptik



• Finite-Elemente-Methode

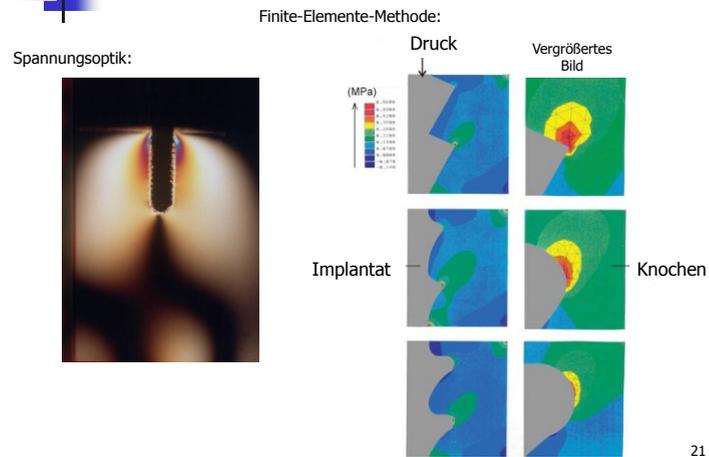


Polariskop:



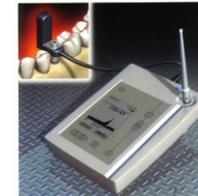
20

Spannungen bei Implantaten



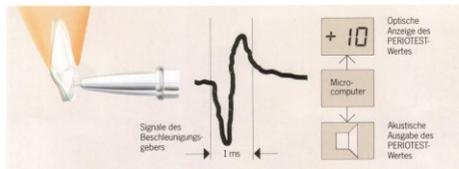
Untersuchung der Stabilität von Implantaten

- Resonanzfrequenzanalyse (RFA)



22

- Periotest



23

Implantatmaterialien

Metalle

- Titan (Ti)



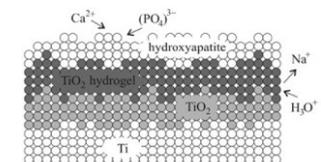
- Titanlegierungen (Z.B. Ti-6Al-4V)
- Kobaltlegierungen (Co-Cr-Mo)

Keramiken

- Aluminiumoxid
- Zirkon (Zirkoniumdioxid)
- HAP
- Biogläser



Metalle mit Keramikbeschichtung



24