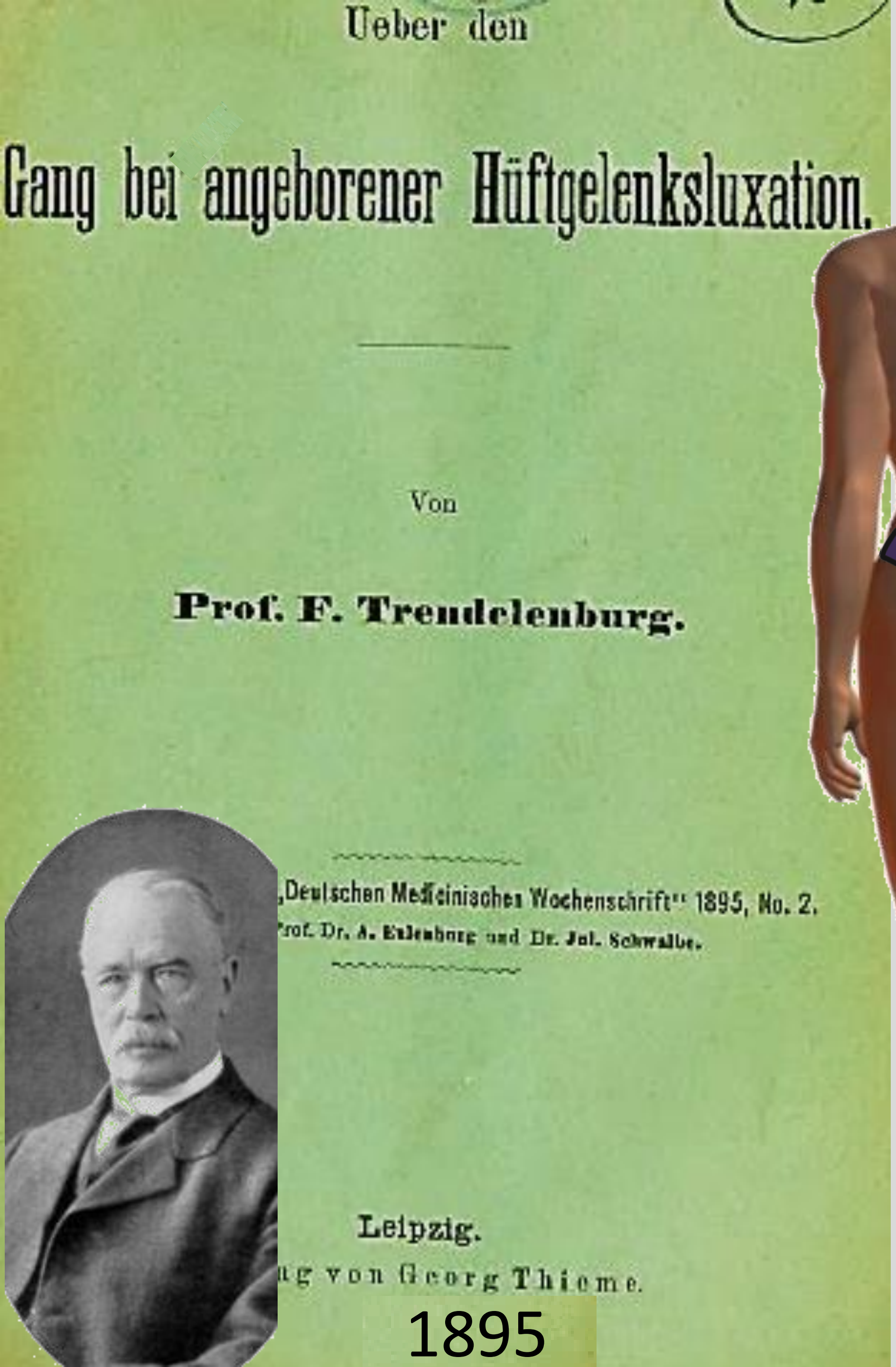
TRENDELENBURG, DUCHENNE EN BALANS

A B C



Ueber den

Gang bei angeborener Hüftgelenksluxation.

Von

Prof. F. Trendelenburg.

„Deutschen Medicinischen Wochenschrift" 1895, No. 2.
Prof. Dr. A. Eulenburg und Dr. Jul. Schwalbe.

Leipzig.
…g von Georg Thieme.

1895

PHYSIOLOGIE
DES MOUVEMENTS
DÉMONTRÉE
A L'AIDE DE L'EXPÉRIMENTATION É… …UE
ET DE L'OBSERVATION CL…
ET APPLICABLE
L'ETUDE DES PARALYSIES ET D… …NS

PAR LE DOCTE…
G. B. DUCHENNE (DE …O…

In welke fase van de gangcyclus treden deze storingen op?

Beide storingen treden op in de unipedale standfase van het aangedane been (dus tijdens de zwaaifase van het niet-aangedane been).

Aangedane been?

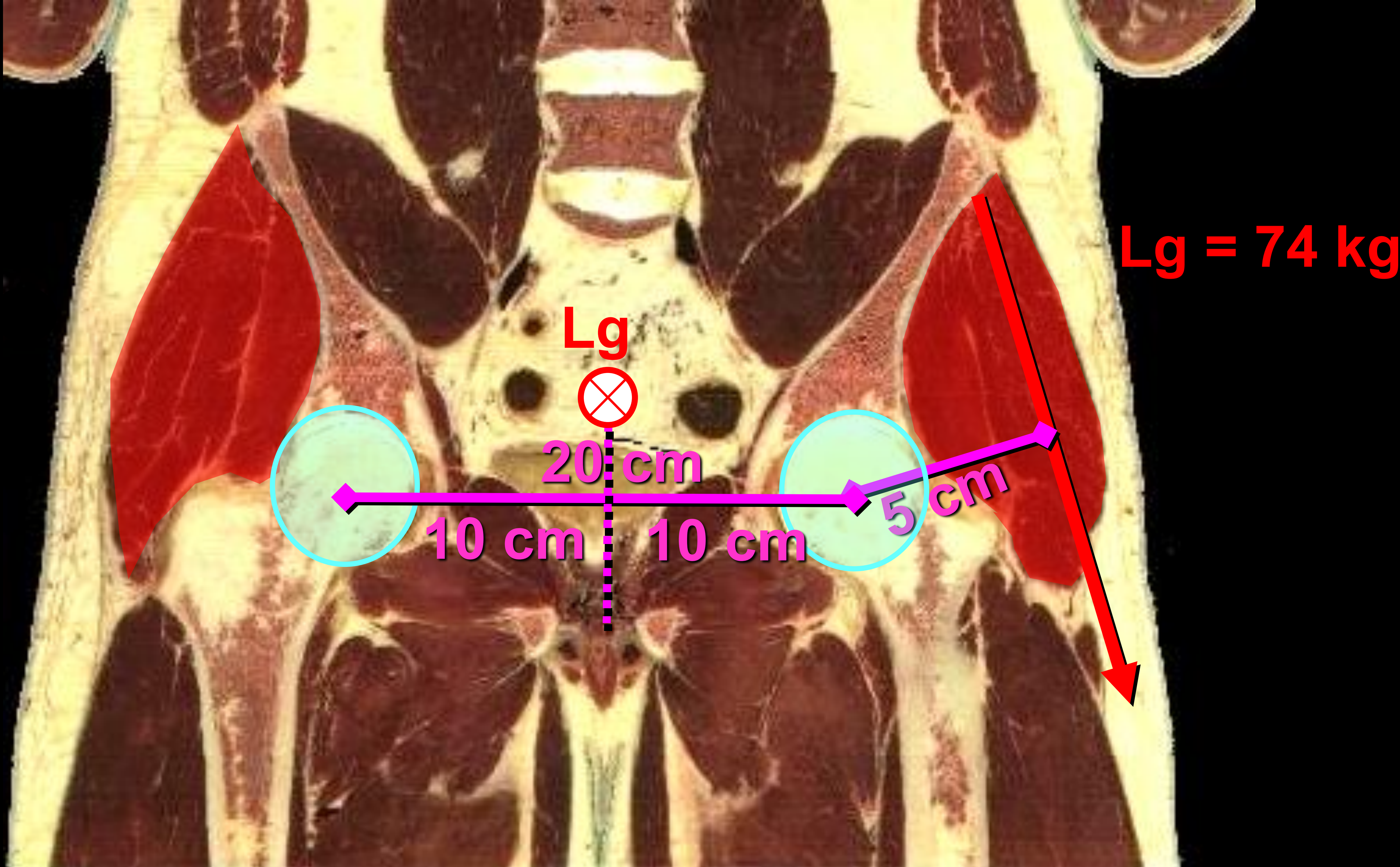
LINKS

Aangedane been?

RECHTS

Welke oorzaken zijn er voor deze gangpatronen ?

Wat zijn de voorwaarden om op 1 been te kunnen staan?


Lg = 74 kg
Lg
20 cm
10 cm
10 cm
5 cm

Stand op 1 been: Inwendig evenwicht

Lg = 74 kg

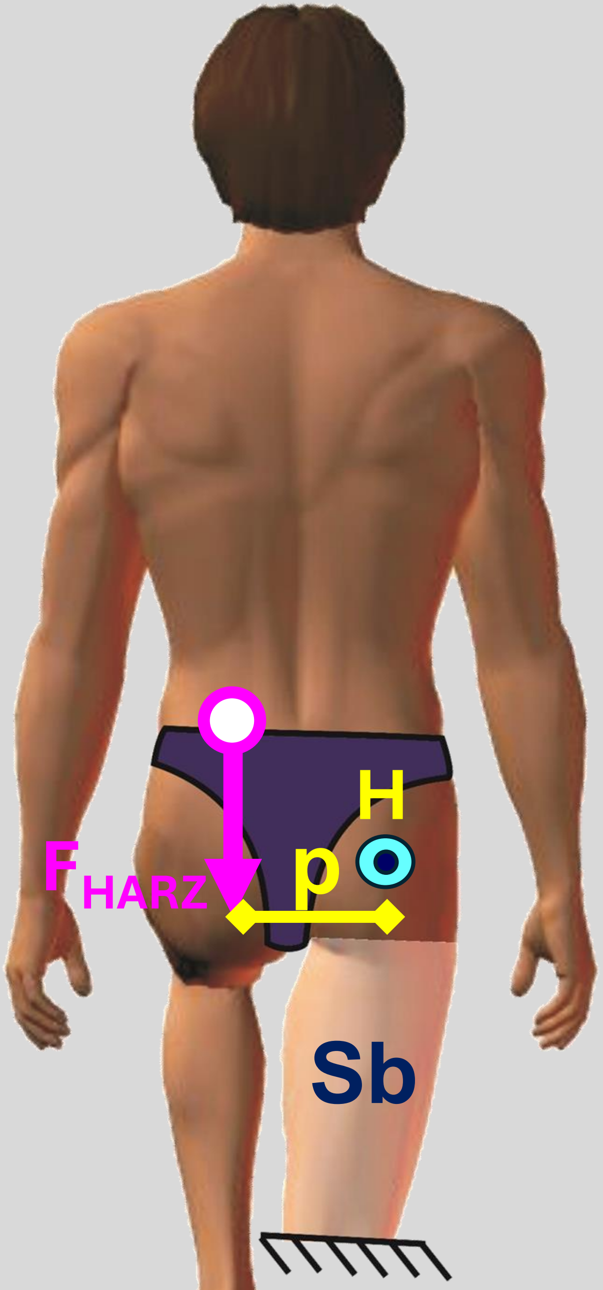
F_{HARZ} = 74-12 = 62 kg

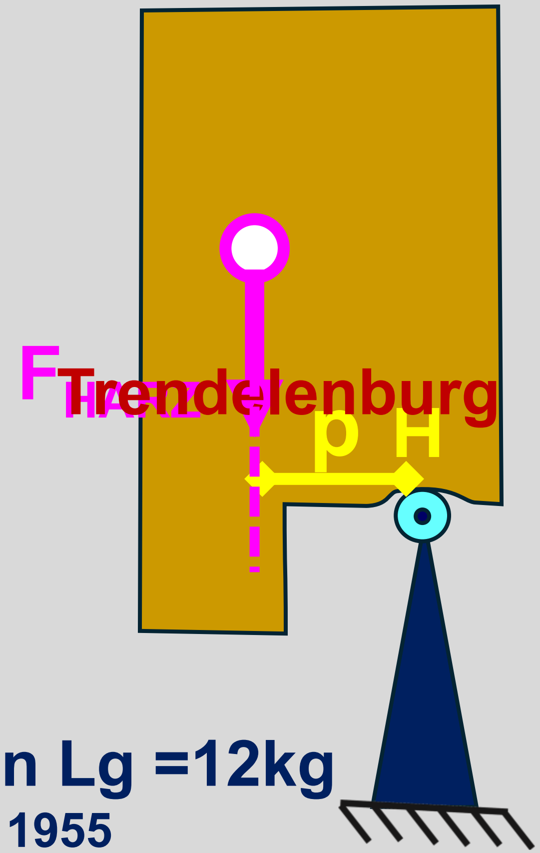
P = 12 cm

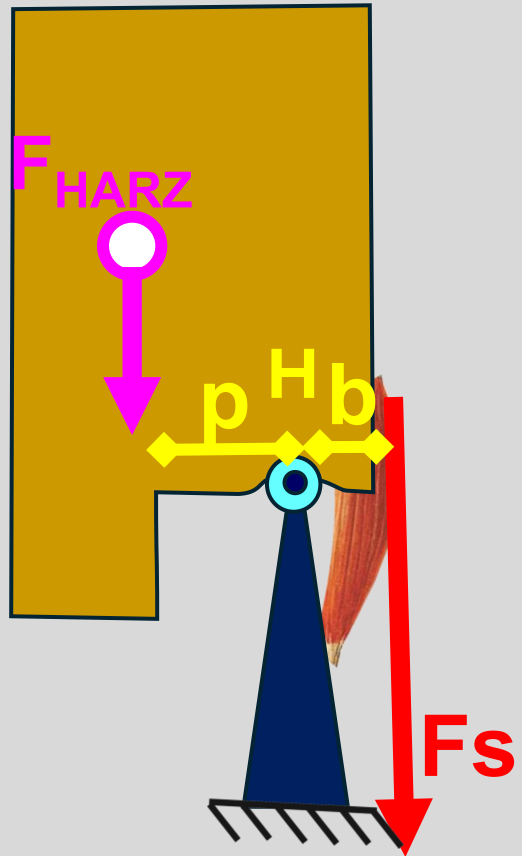
$F_S \times b = F_{HARZ} \times p$

$Fs = (62 \times 12) / 5$
$= 148$ kgf

b=5 cm





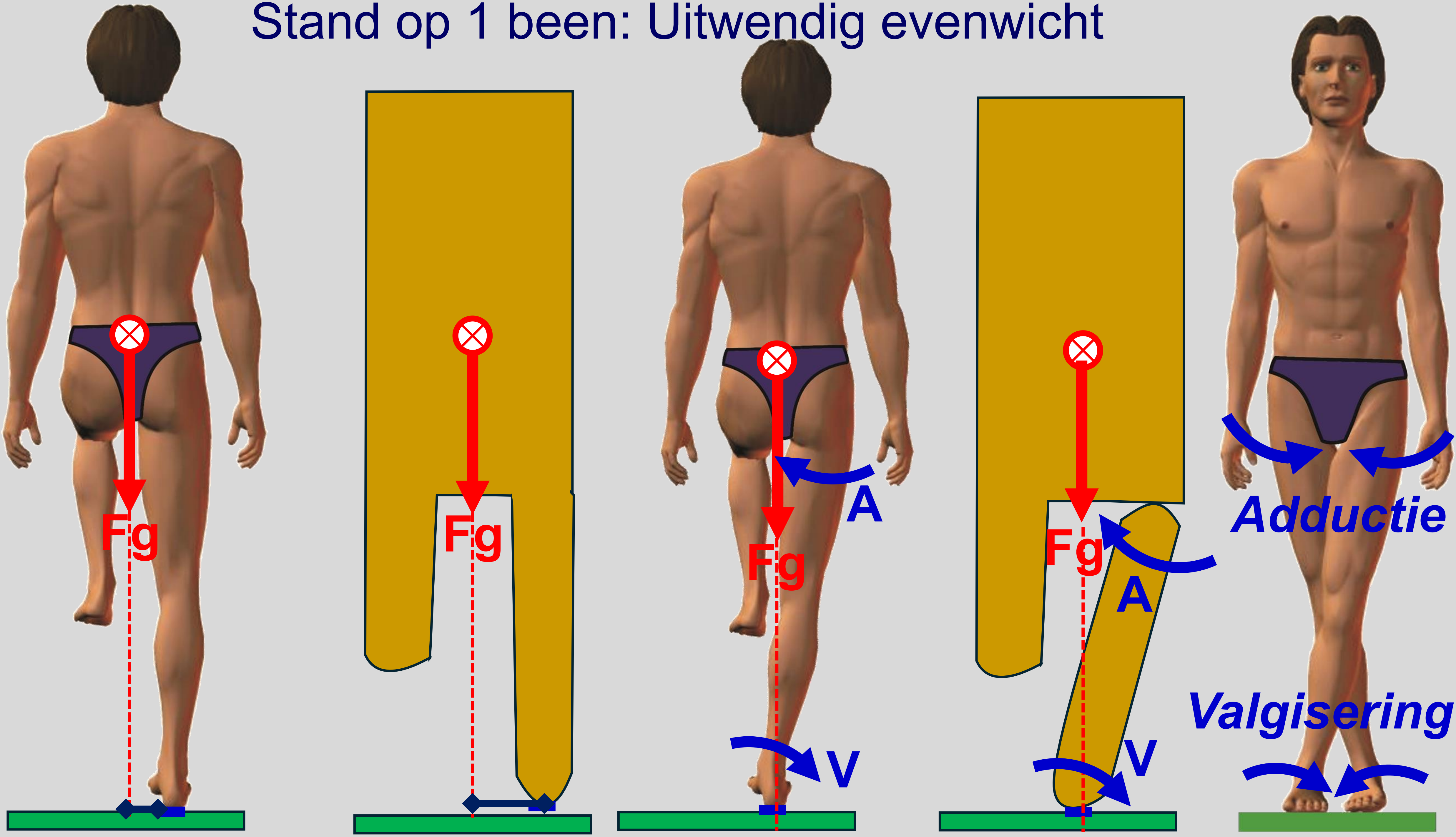


Sb=16% van Lg =12kg

W.T. Dempster 1955

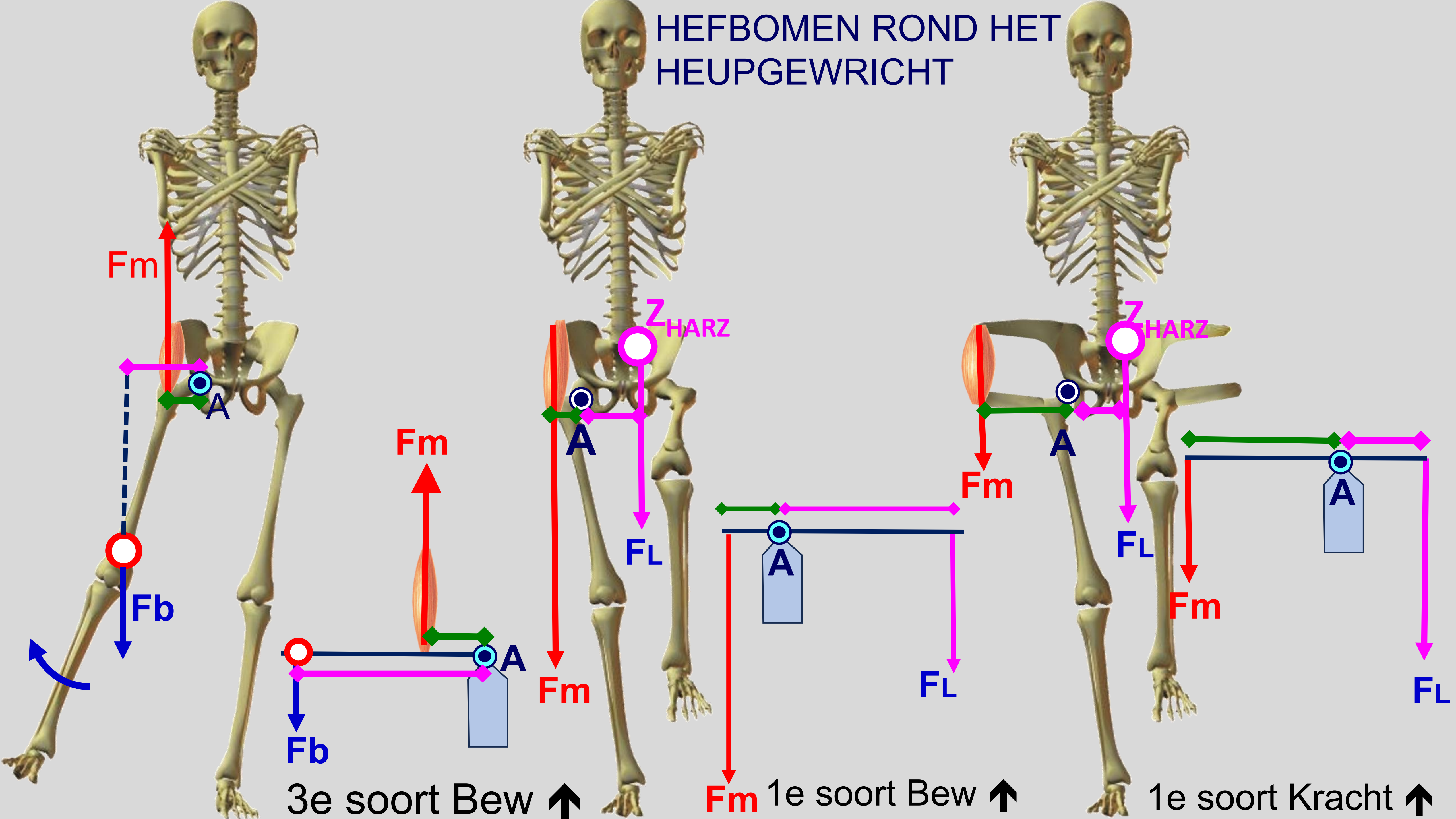
UITWENDIG EVENWICHT:
ZWAARTEPUNT EN STEUNVLAK

Stand op 1 been: Uitwendig evenwicht



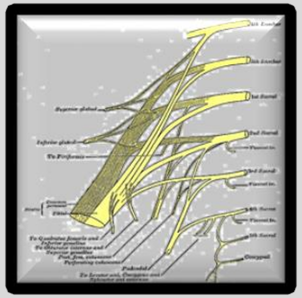

HEFBOMEN
rond het heupgewricht

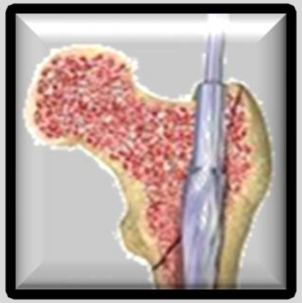
HEFBOMEN ROND HET HEUPGEWRICHT



Oorzaken van onvoldoende abducerende momenten rond het heupgewricht van het standbeen:

- *parese/paralyse van de heupabductoren;*

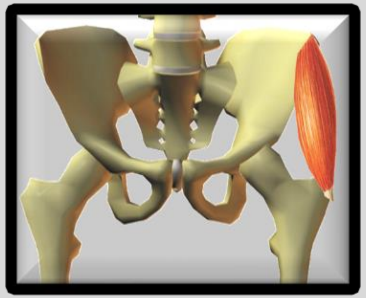




- *beschadiging heupabductoren → contractie pijnlijk;*

- *een intraossale veneuze hypertensie in de femur-kop bij coxarthrosis deformans;*

- *een vermindering van de origo-insertie-afstand en/of een verkleining van de momentsarm van de heup-abductoren.*



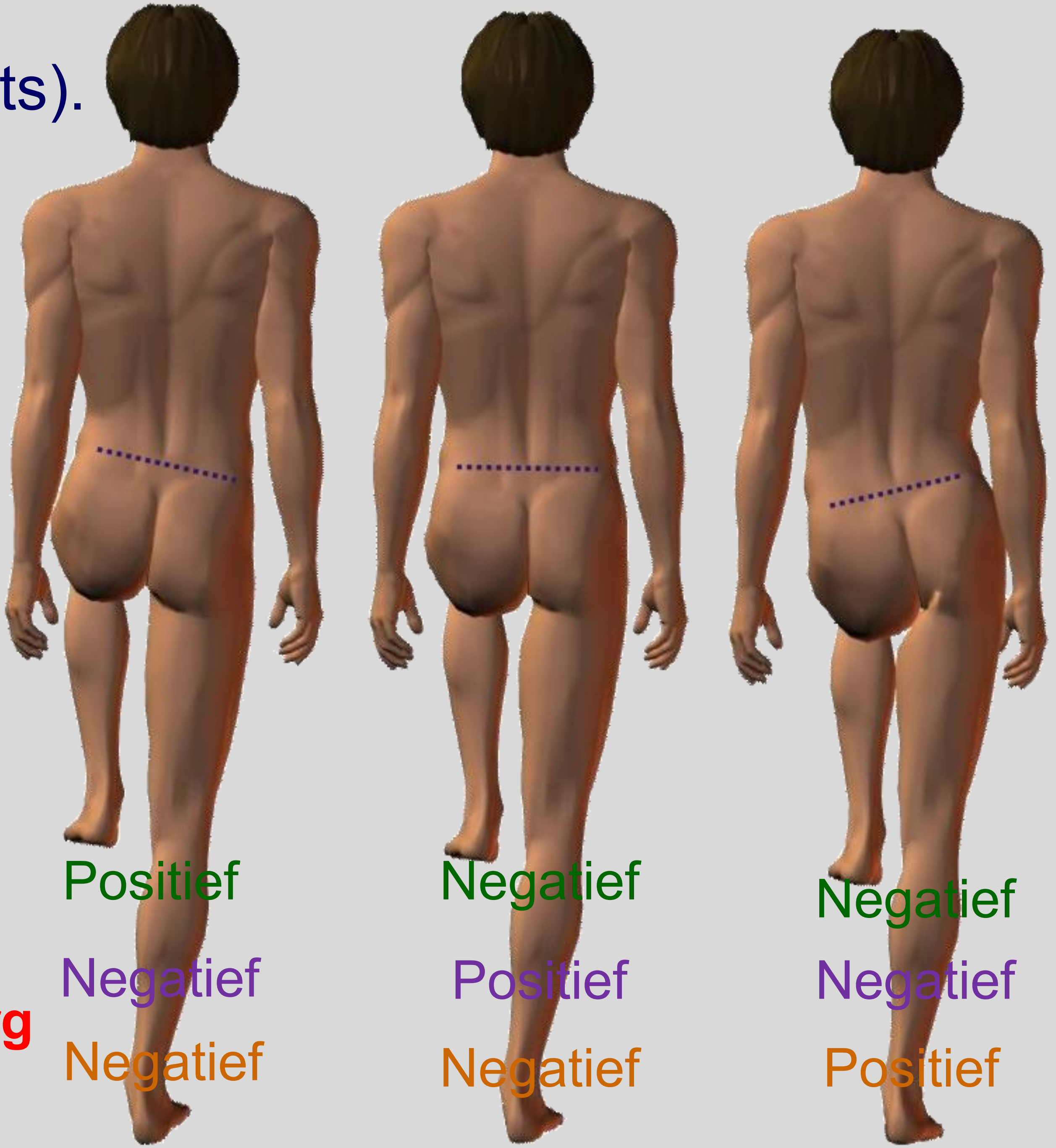
Criteria voor de beoordeling van de Trendelenburg-test (abductoren rechts).

<u>Criterium 1:</u>
Het bekken *moet stijgen*: zo ja positief, zo nee negatief.

Criterium 2:
Het bekken *moet horizontaal blijven:* zo ja positief, zo nee negatief.

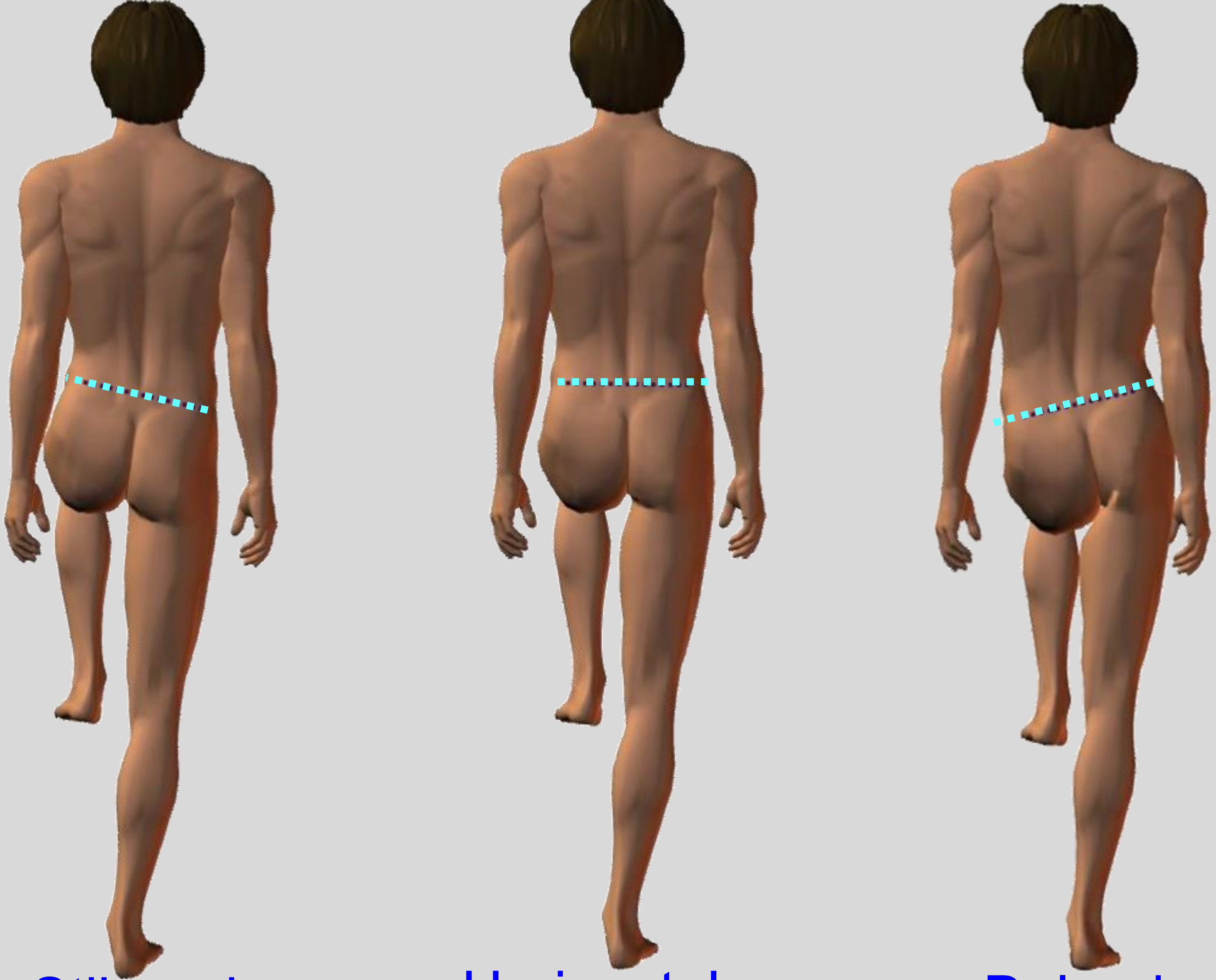
Criterium 3:
Het bekken *mag niet dalen*: zo ja positief, zo nee negatief.

Een positieve of negatieve Trendelenburg kan dus alles betekenen: bekken stijgt, bekken horizontaal, bekken daalt.



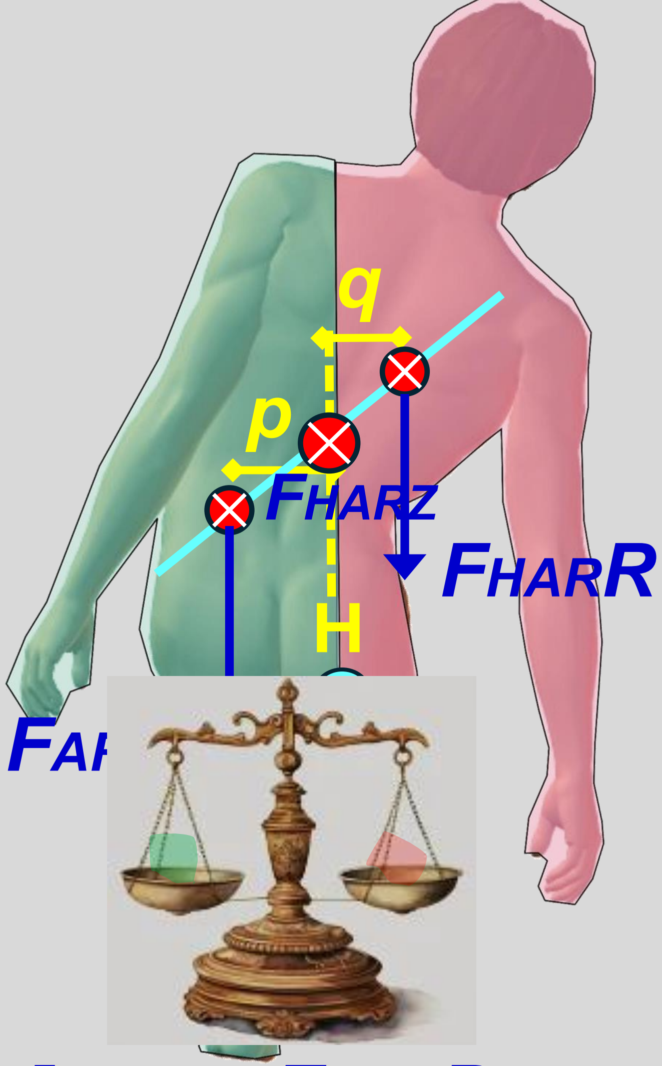
Criteria voor de beoordeling van de Trendelenburg-test.

Voorstel:
De beschrijvende Trendelenburg-score.



Stijgende Trendelenburg | Horizontale Trendelenburg | Dalende Trendelenburg

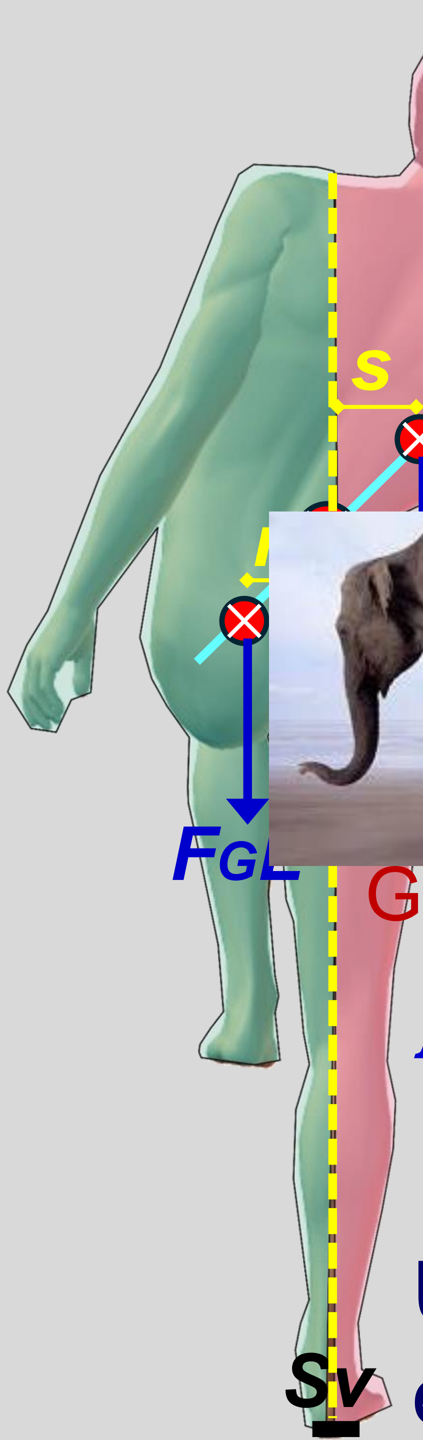
Hoe werkt de gang van Duchenne?



$FARZL \times p = FHARR \times q$

Geen abductoren nodig!

Inwendig evenwicht



uctie heup nodig!

Geen valgus enkel nodig!

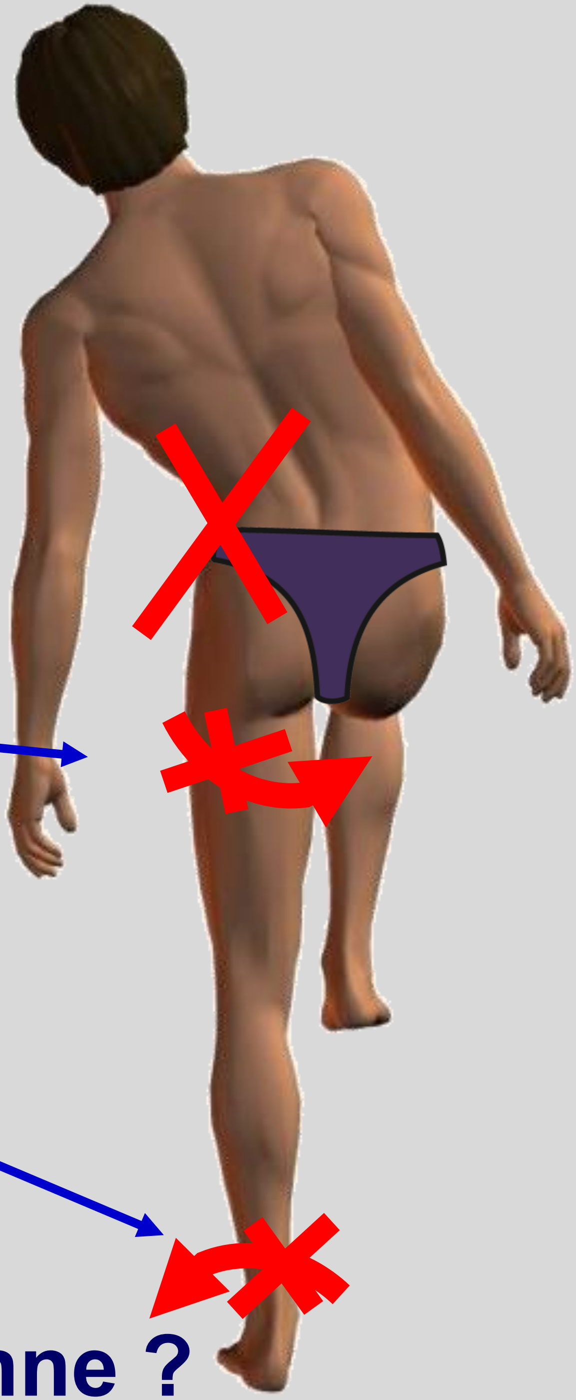
$FGL \times r = FGR \times s$

Uitwendig evenwicht

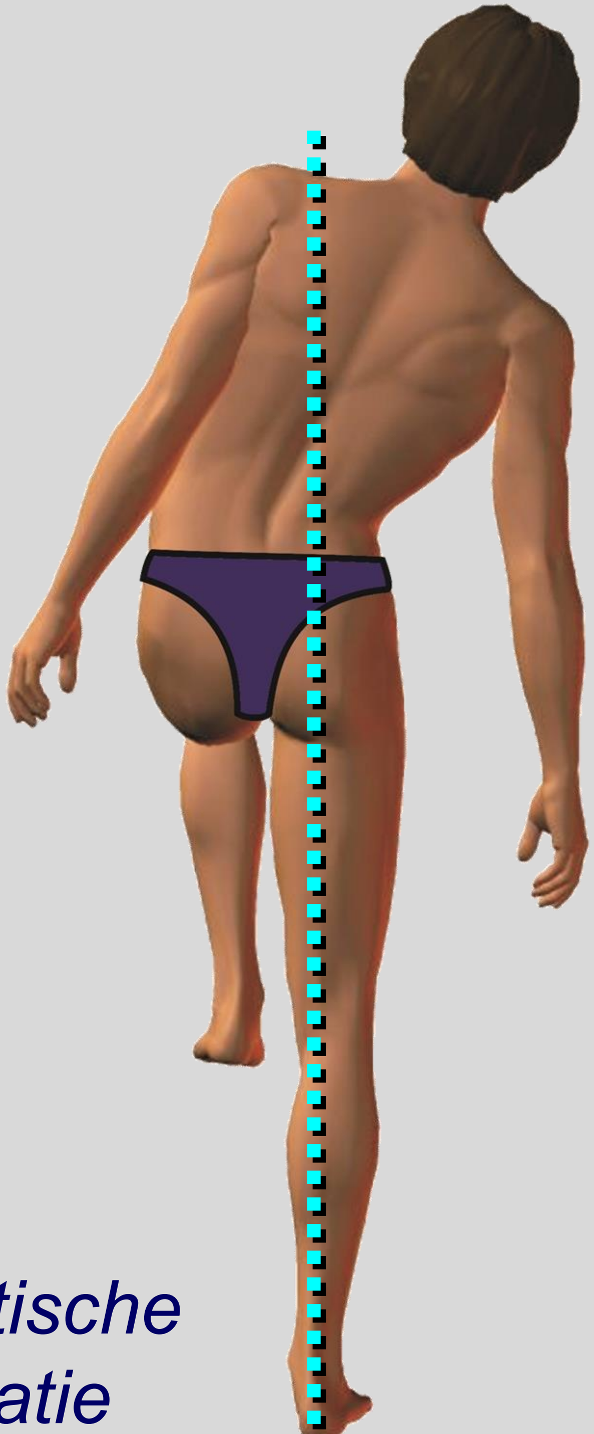
Onvoldoende F abductoren

Onvoldoende adductie heup

Onvoldoende valgisering enkel



Trendelenburg ? **of** **Duchenne ?**



Statische situatie

Dynamische situatie: de rompuitwijking is veel minder groot dan in de statische situatie!

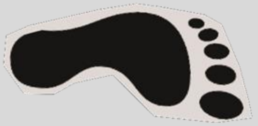
Zelfs bij zeer lage gangsnelheden (ca. 1 km/uur) wordt een gang van Duchenne al gemaskeerd!

Relatief geringe steun kan de Duchenne volledig maskeren.

Dynamische situatie

Ontlasting van enkel / knie en heup door een wandelstok

Steunvlak en maximale belasting op een handvat

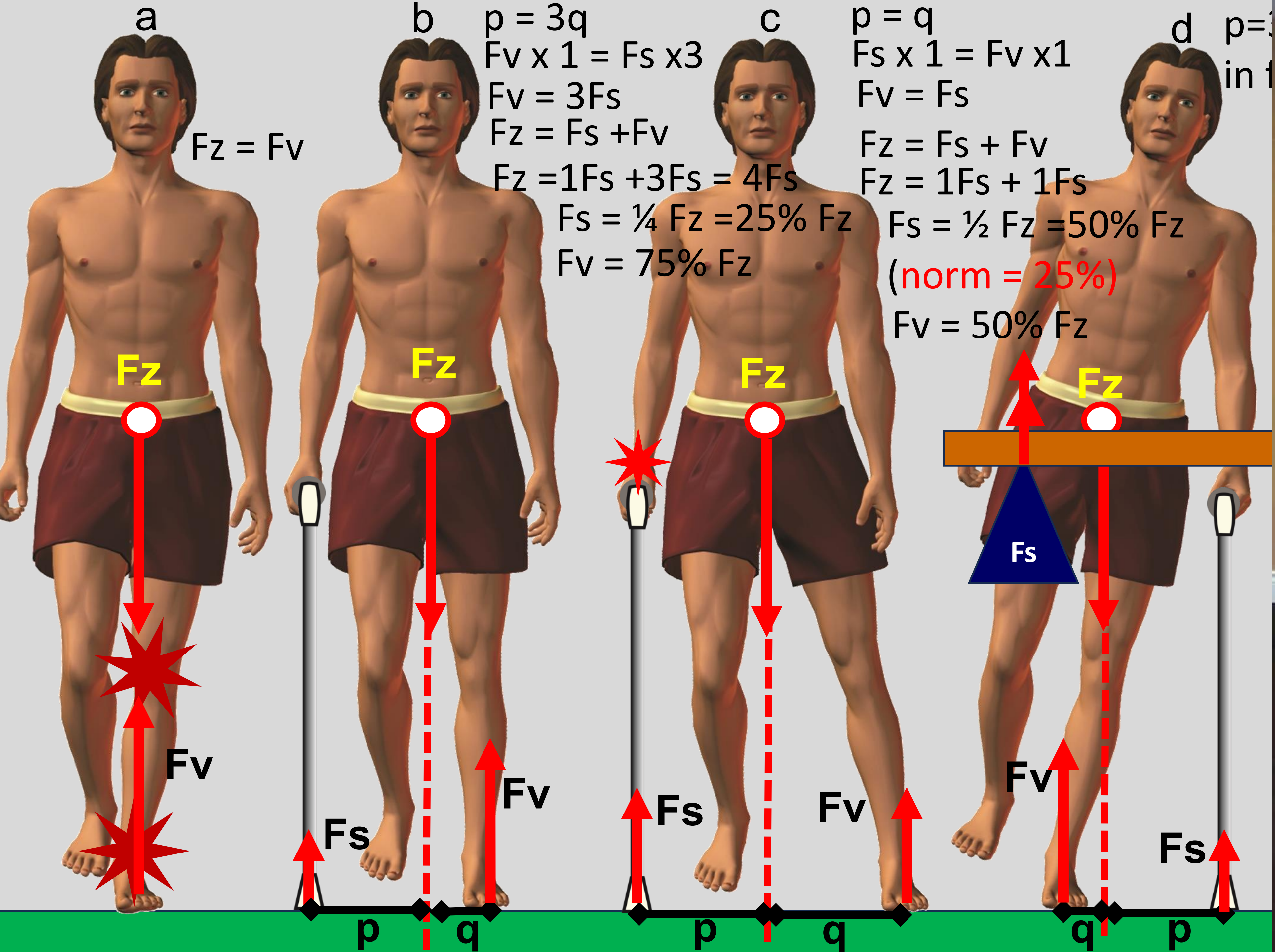


Maximale belasting handvat (Lg = 74 kg):

11 – 34 % LG = 8 – 25 kgf

Gemiddeld: ***25% LG = 18,5 kgf***

14. Anglin C, Wyss U. Arm motion and load analysis of sit-tostand, stand-to-sit, cane walking and lifting. ClinBiomech. 2000;15(6):441–8.
15. Aragaki D, Nasmyth M, Schultz S, Nguyen G, Yentes J, Kao K, Perell K, FangM. Immediate effects of contralateral and ipsilateral cane use on normal adult gait. PM R.2009;1(3):208–13.
16. Brand R, Crowninshiel R. The effect of cane use on hip contact force. ClinOrthopRelatRes. 1980;147:181–3.
17. Deckers J, Beckers D. Ganganalyse en looptraining voor de paramedicus. Houten/Diegem: BohnStafleu vanLoghum; 1996.
18. Fang M, Heiney C, Yentes J, Harada N, Masih S, Perell-Gerson K. Effects of contralateral versus ipsilateral cane use on gait in people with knee osteoarthritis. PM R. 2015;7:400–6.
19. Lyu S,Ogata K,Hoshiko I. Effects of a cane on floor reaction force and center of force during gait. Clin OrthopRelatRes. 2000;375:313–9.
20. Sherif S, Hasan S, Arnold G, Abboud R, Wang W. Analysis of hand pressure in different crutch lengths and upperlimb movements during crutch walking. Int J Ind Ergon. 2016;53:59–66.
21. WinterD,DeatheA,HallidayS, IshacM,OlinM. A technique to analyse the kinetics and energetics of cane-assisted gait. ClinBiomech. 1993;8:37–43.
22. Youdas J, Kotajarvi B, Padgett J, Kaufman K. Partial weight bearing gait using conventional assistive devices. ArchPhys MedRehabil. 2005;86:394–8.
23. Youdas J, Kotajarvi B, Padgett J, Kaufman K. Partial weight-bearing gait using conventional assistive devices. Arch Phys Med Rehabil 2005;86:394-8.



a
Fz = Fv
Fz
Fv
b
p = 3q
Fv x 1 = Fs x3
Fv = 3Fs
Fz = Fs +Fv
Fz =1Fs +3Fs = 4Fs
Fs = ¼ Fz =25% Fz
Fv = 75% Fz
Fz
Fs
Fv
p
q
c
p = q
Fs x 1 = Fv x1
Fv = Fs
Fz = Fs + Fv
Fz = 1Fs + 1Fs
Fs = ½ Fz =50% Fz
(norm = 25%)
Fv = 50% Fz
Fz
Fs
Fv
p
q
d
p=
in
Fz
Fs
Fv
Fs
q
p

HEUP- ONTLASTING

Lg = 74 kg

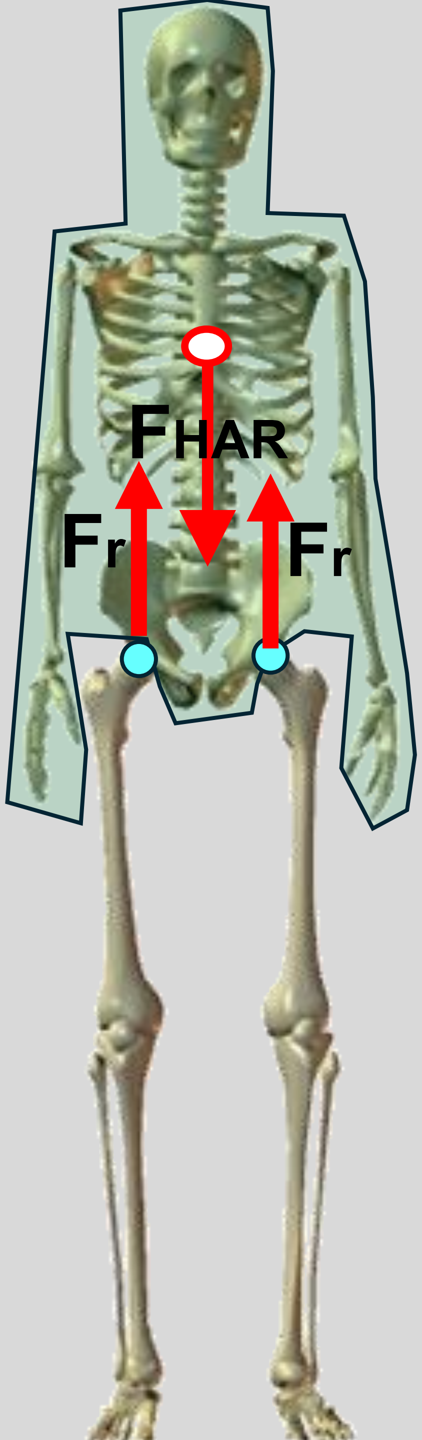
Been =16% van Lg =12kg

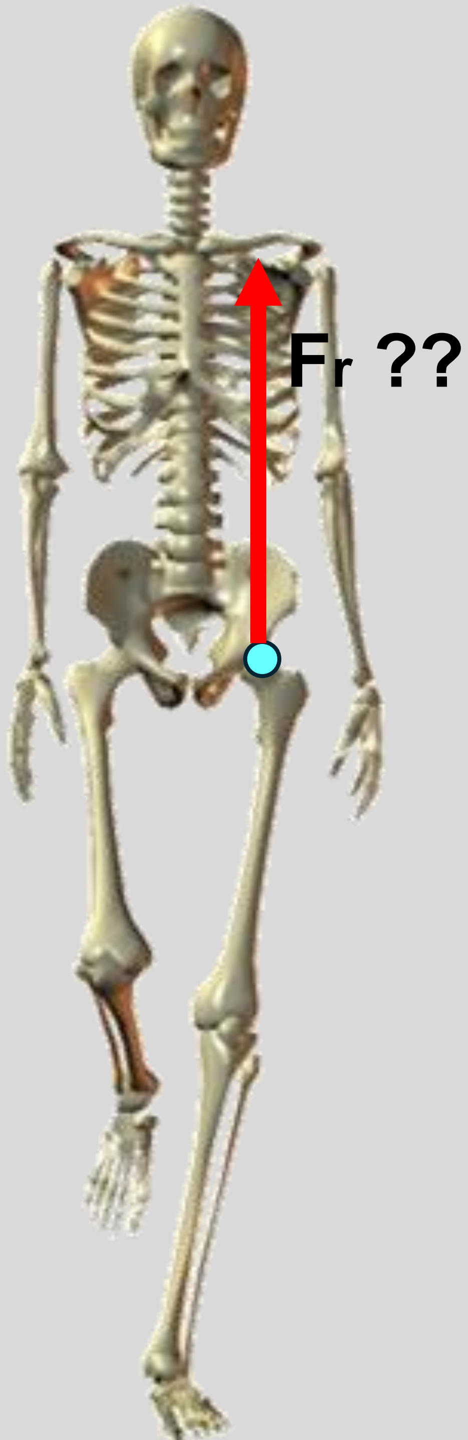
F_{HAR} = 74 - (2 ×12) = 50 kgf

Wat is de belasting van de heupgewrichten (Fr)?

50 ÷ 2 = 25 kgf

Stand op één been:
wat is nu de belasting van het heupgewricht ?





HEUP- ONTLASTING

Fg =74 kgf → Fharz 62 kgf.

p=12cm q=5 cm

$Fs \times q = Fharz \times p$

$Fs = (Fharz \times p)/q$

$Fs = (62 \times 12)/5 = 148$ kgf

$Fr = Fharz + Fs = 62+148 = 210$ kgf

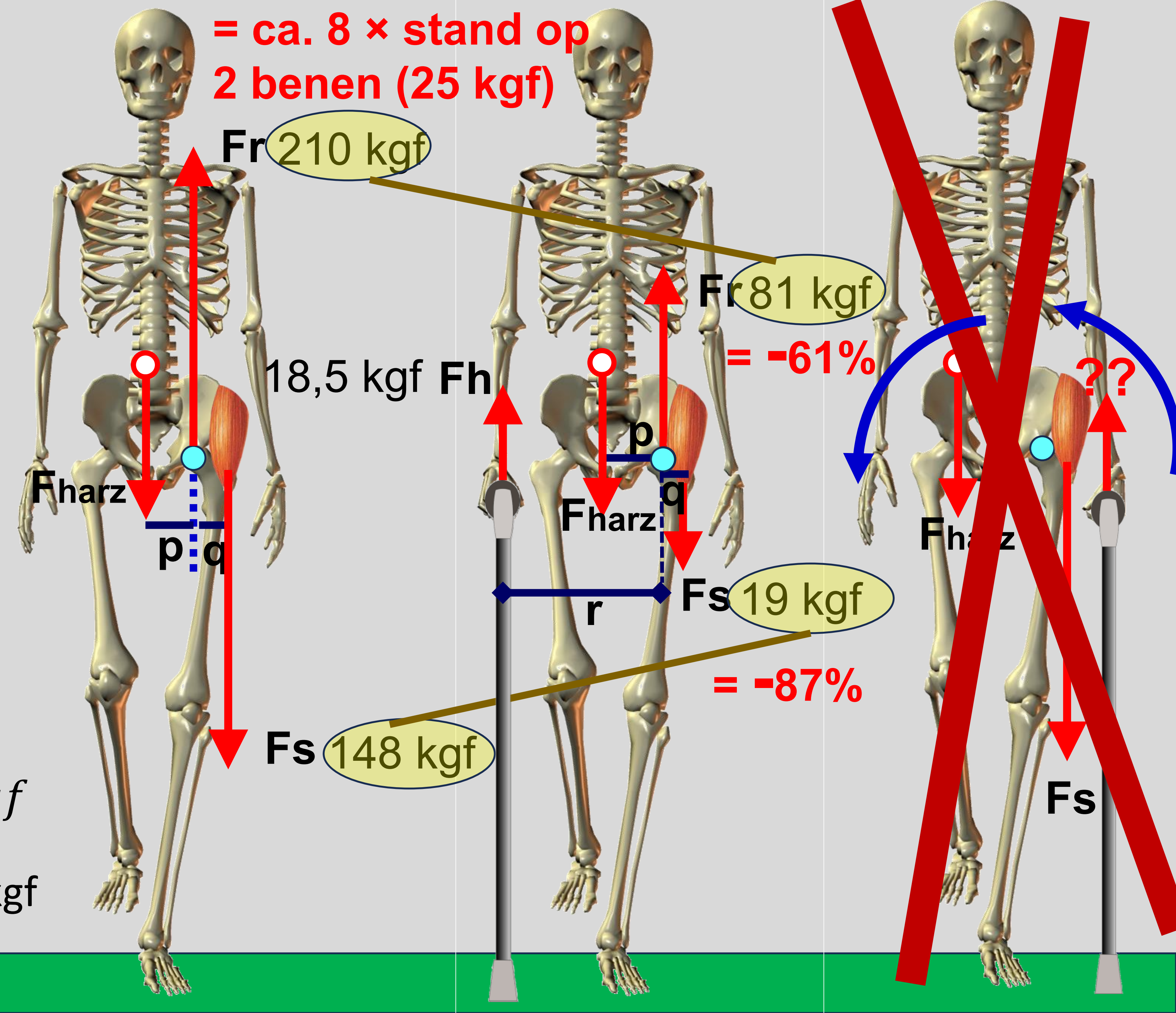
$Fh = 25\%$ van $Fg = 18{,}5$ kgf

$r = 35$ cm $q = 5$ cm

$$Fs \times q + Fh \times r = F_{harz} \times p$$

$$Fs = \frac{62 \times 12 - 18{,}5 \times 35}{5} = 19\ kgf$$

$Fr = F_{harz} + Fs = 62 + 19 = 81$ kgf



HEUP- ONTLASTING DOOR TOEVOEGEN VAN EEN LAST

Ter vergelijk:

$Flast = 14{,}5\ kgf \qquad r = 25\ cm$

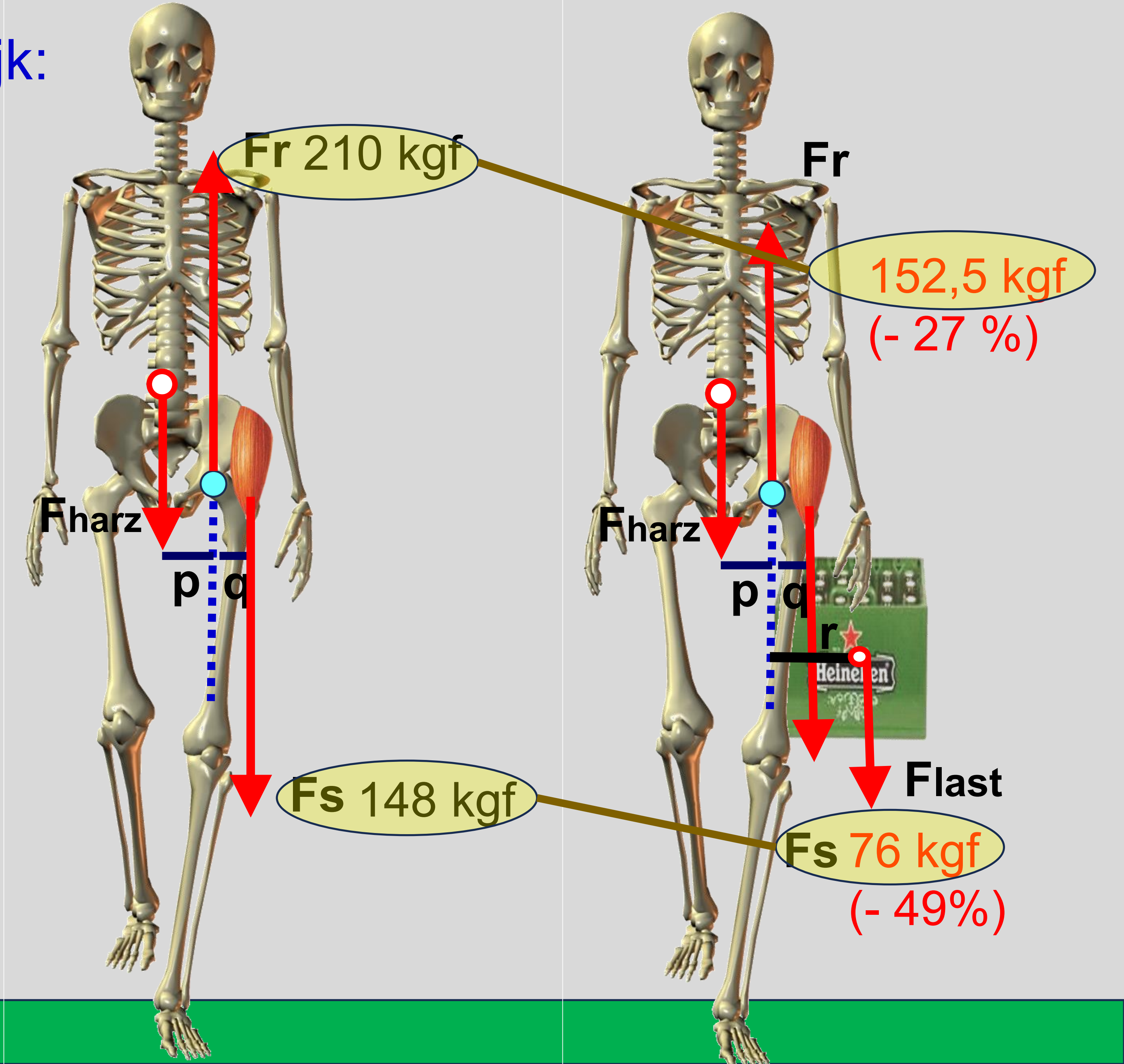
$Fs \times q\ + Flast \times r\ = Fharz\ \times p$

$Fs = (Fharz \times p - Flast \times r)/q$

$Fs = (62 \times 12 - 14{,}5 \times 25)\ /\ 5 = 76\ kgf$

$Fr = Fs + Fharz + Flast$

$Fr = 76 + 62 + 14{,}5 = \ 152{,}5\ kgf$



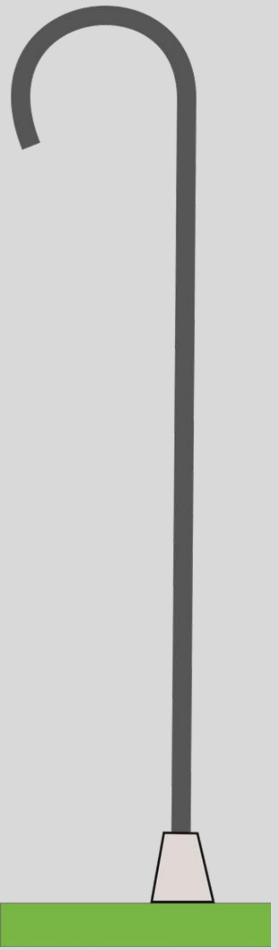
De wandelstok en balans

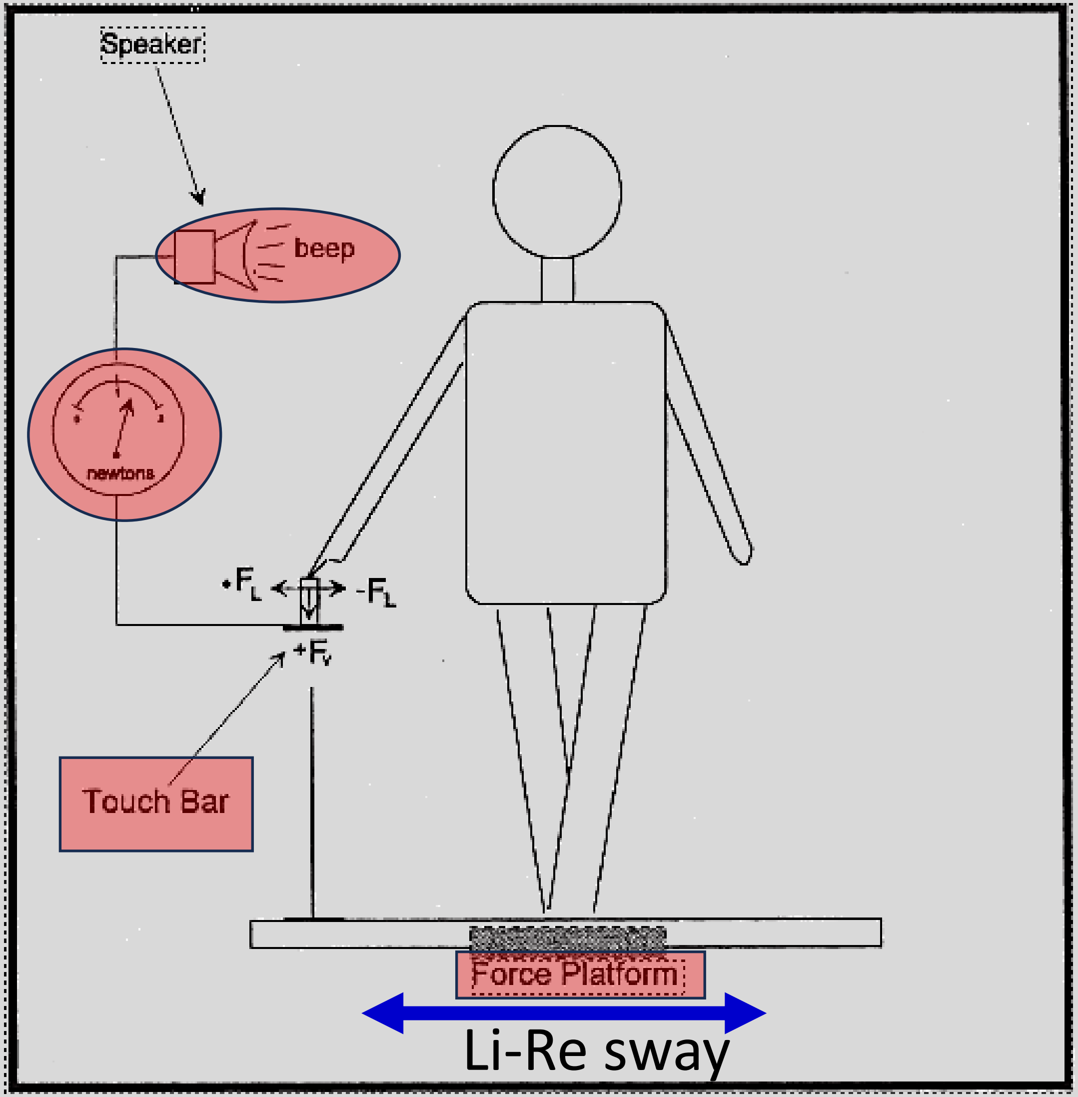
Handvatvormen

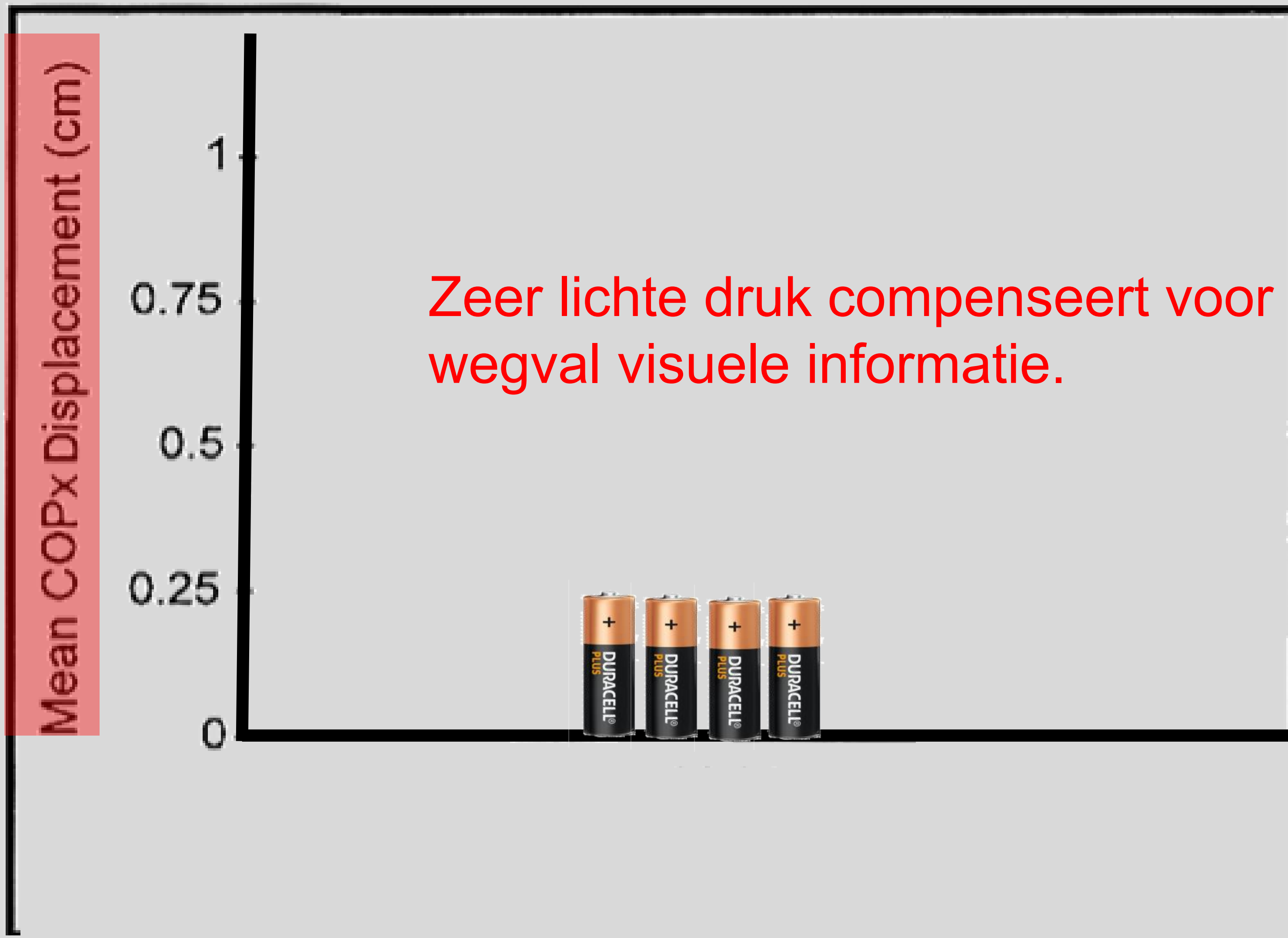
Rondhaak (schaap-herder)

Recht hoekig

Derby of Fritz



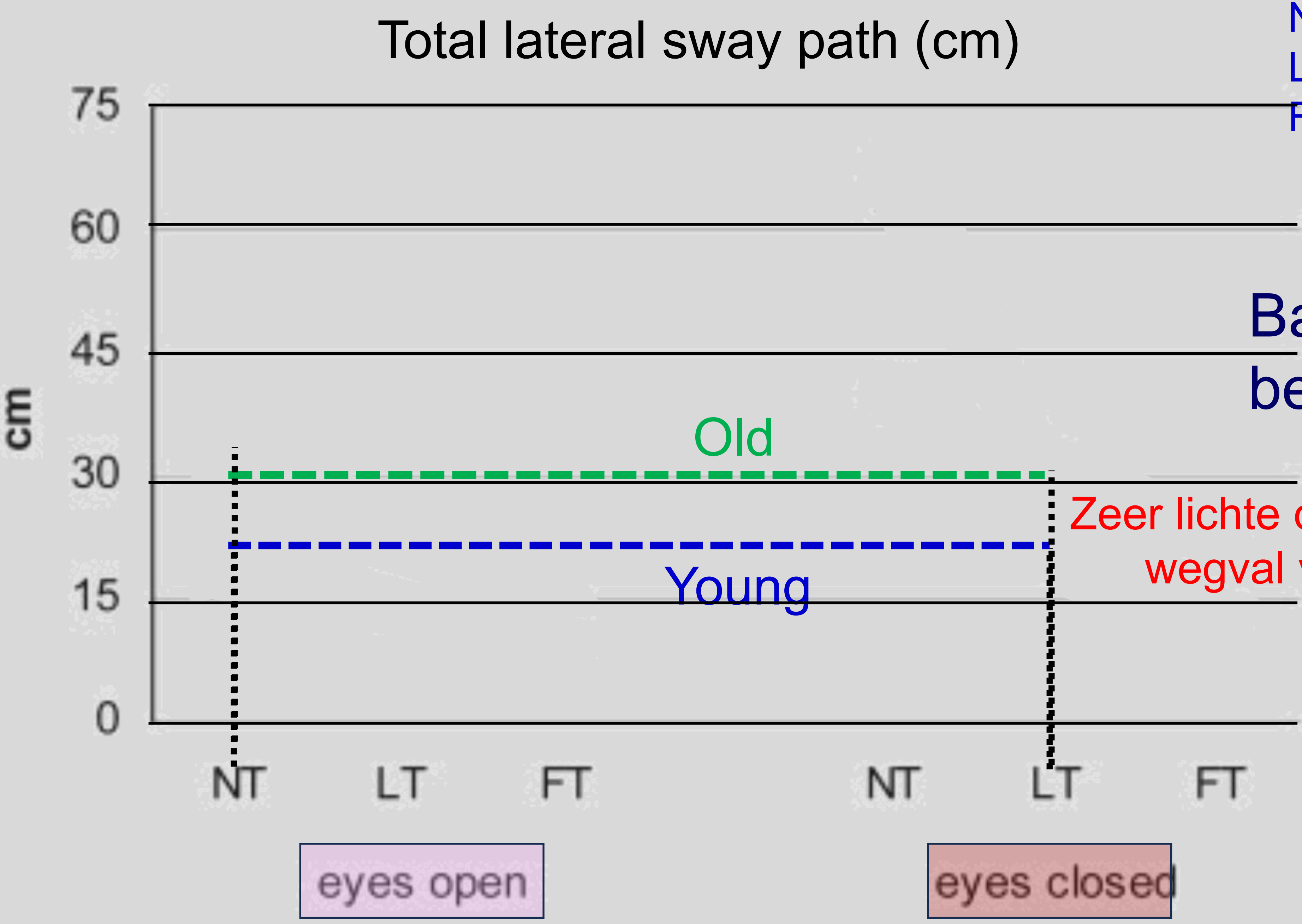




Balans bij minimale belastingen.

Jeka J. Light Touch Contact as a Balance Aid. Physical Therapy 1997;77(5):476-487.

Belasting:
NT = ZERO
LT = 1 N (=100 g = 1 ons)
FT = MAX

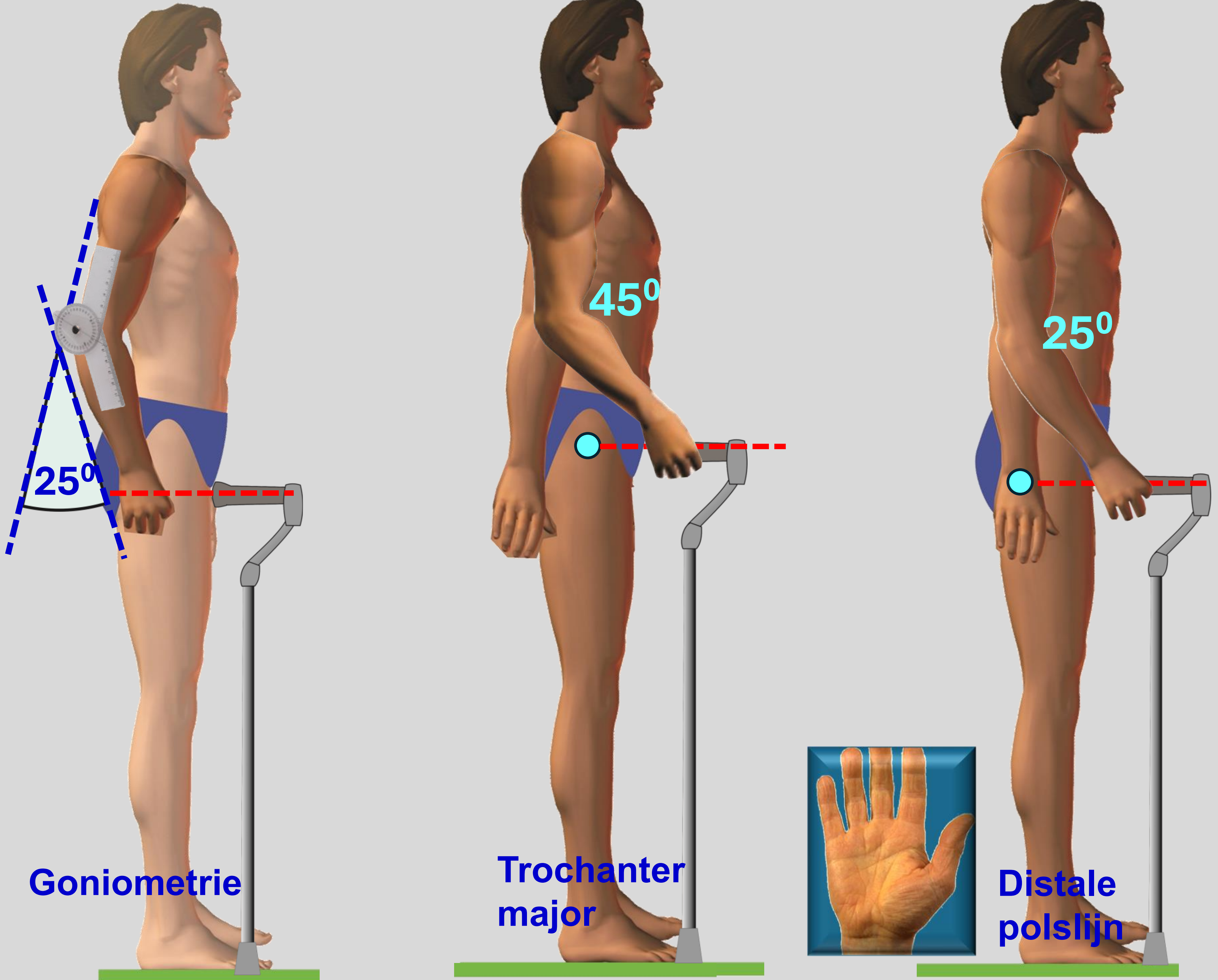


Balans bij minimale belastingen

Zeer lichte druk compenseert voor wegval visuele informatie.

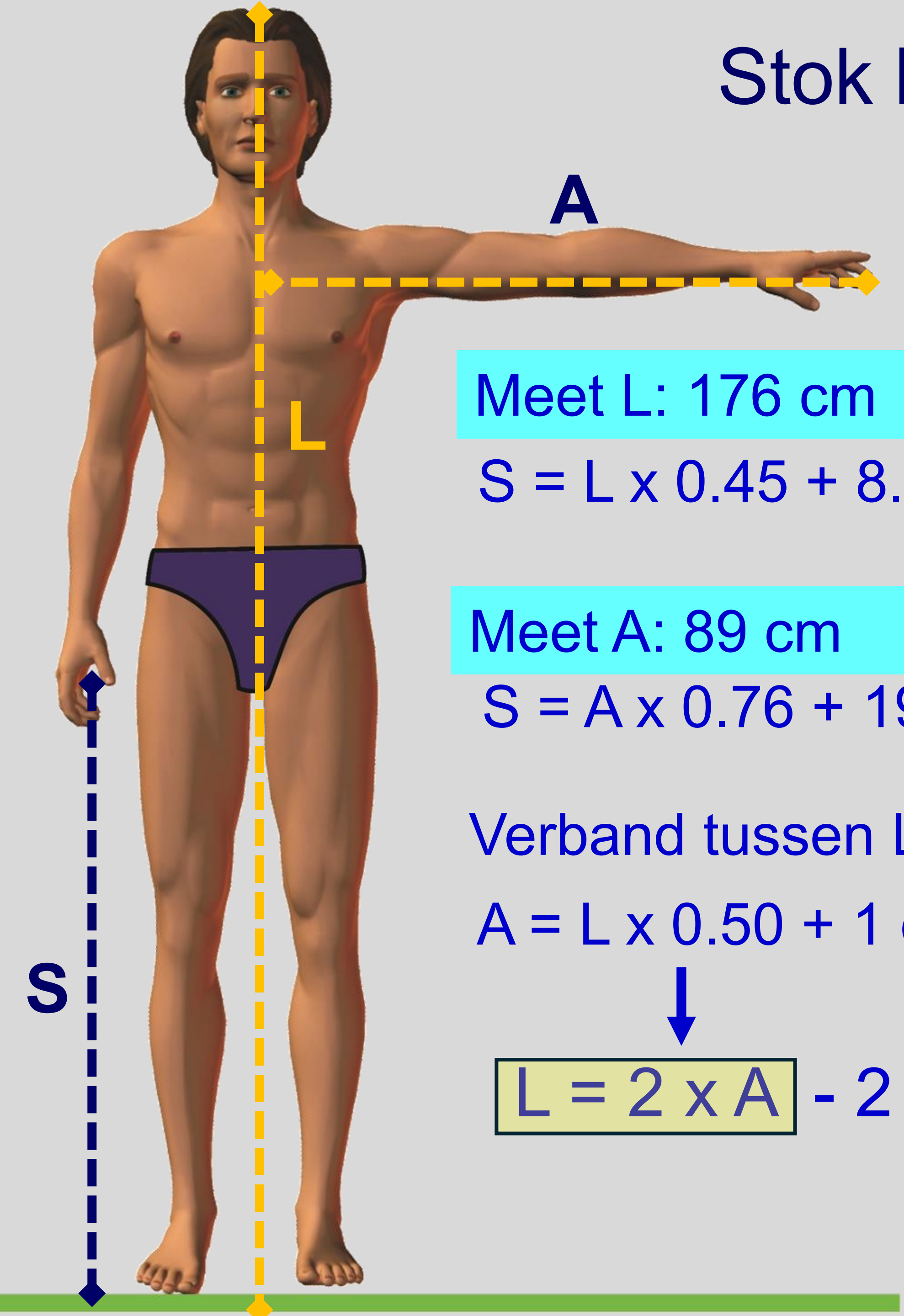
Baccini M, Rinaldi L, Federighi G, Vannucchi L, Paci M, Masotti G. Effectiveness of fingertip light contact in reducing postural sway in older people. Age and Ageing 2007;36: 30–5

Stok lengte



Kumar R, Roe M, Scremin O. Methods for estimating the proper length of a cane. Arch Phys Med Rehabil 1995;76:1173-5.

Stok lengte: regressie vergelijkingen



Meet L: 176 cm
$S = L \times 0.45 + 8.7$ cm

S = 88 cm

Meet A: 89 cm
$S = A \times 0.76 + 19$ cm

S = 87 cm

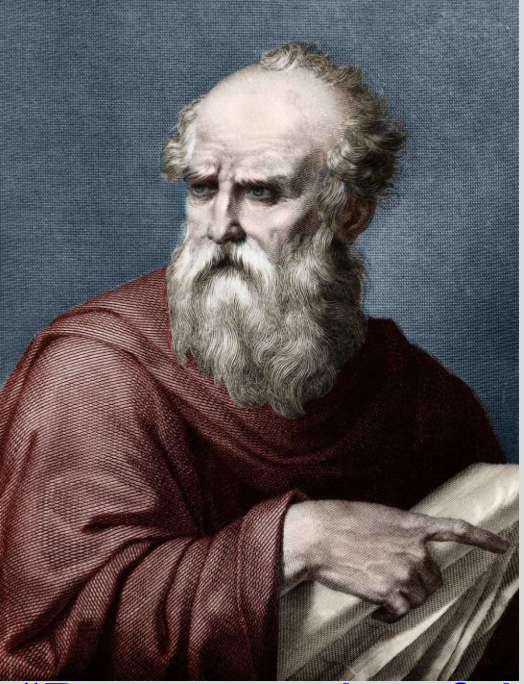
Verband tussen L en A

$A = L \times 0.50 + 1$ cm

$\downarrow$

$\boxed{L = 2 \times A}$ - 2 cm

Kumar R, Roe M, Scremin O. Methods for estimating the proper length of a cane. Arch Phys Med Rehabil 1995;76:1173-5.



Marcus Vitruvius Pollio

Architect

85 – 20 v. Chr

De Architectura

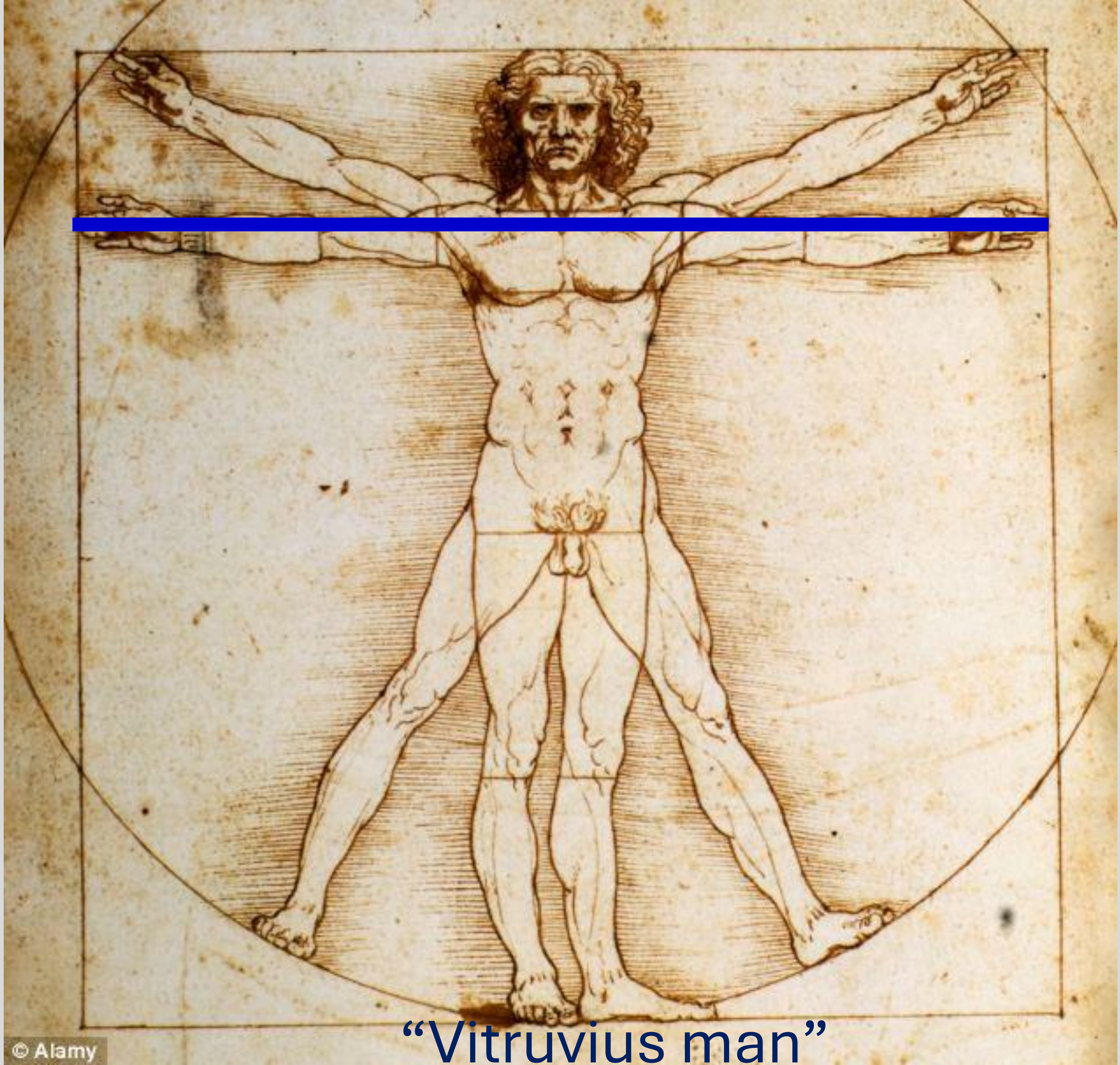
M· VITRVVII POLLIONIS
DE ARCHITECTVRA
CVM COMMENTARIIS
MVLTIS AEDIFICIORVM, HOROLOGIORVM,
CVM PRIVILEGIIS.
VENETIIS,
M. D. LXVII.

"De natuur heeft het menselijk lichaam zo gevormd dat:

- een open gespreide armspanwijdte gelijk is aan de lichaamslengte;
- het hoofd een achtste van de totale lichaamslengte is;
- het gezicht een tiende van de lengte is;
- de voet een zesde is van de lengte van het lichaam;
- de onderarm (van elleboog tot hand) een vierde is;
- de handpalm een tiende is;
- en zo verder."

Leonardo da Vinci
1452-1519

1490

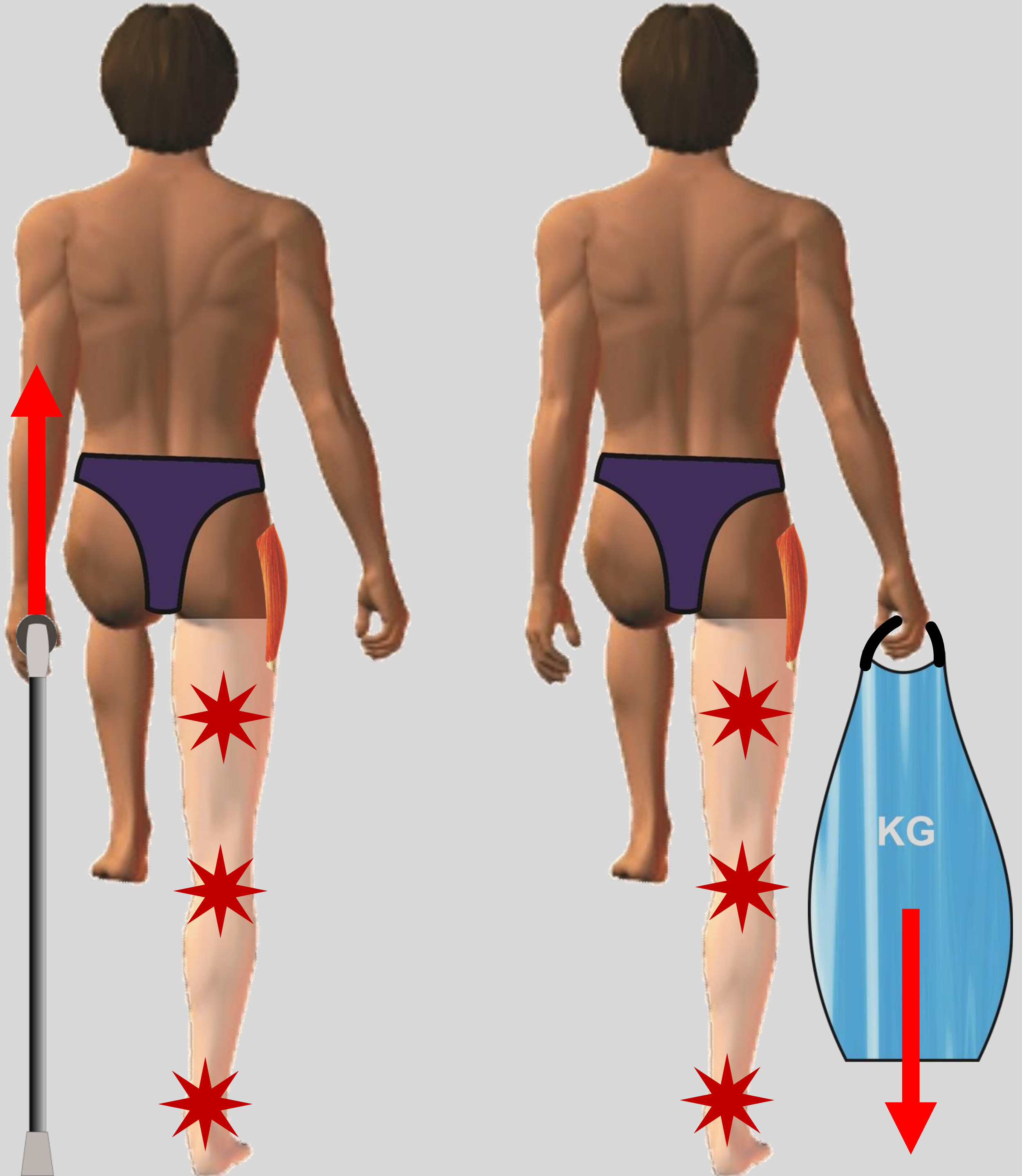


“Vitruvius man”

Om te onthouden:

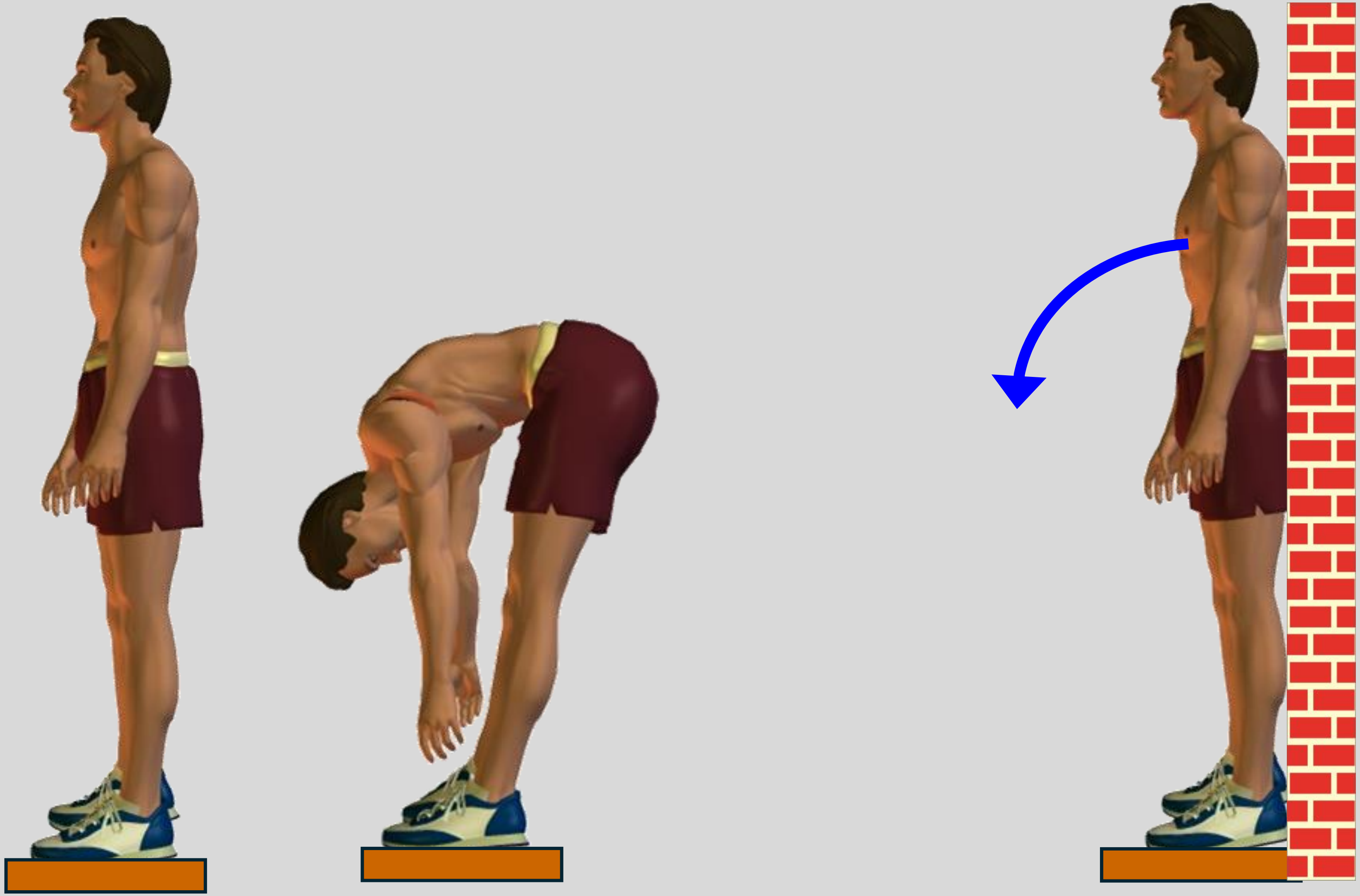
Een stok altijd gebruiken aan de *gezonde* zijde.

Bij verzwakte heupabductoren (Duchenne en Trendelenburg) moet een last aan de *aangedane* zijde worden gedragen.

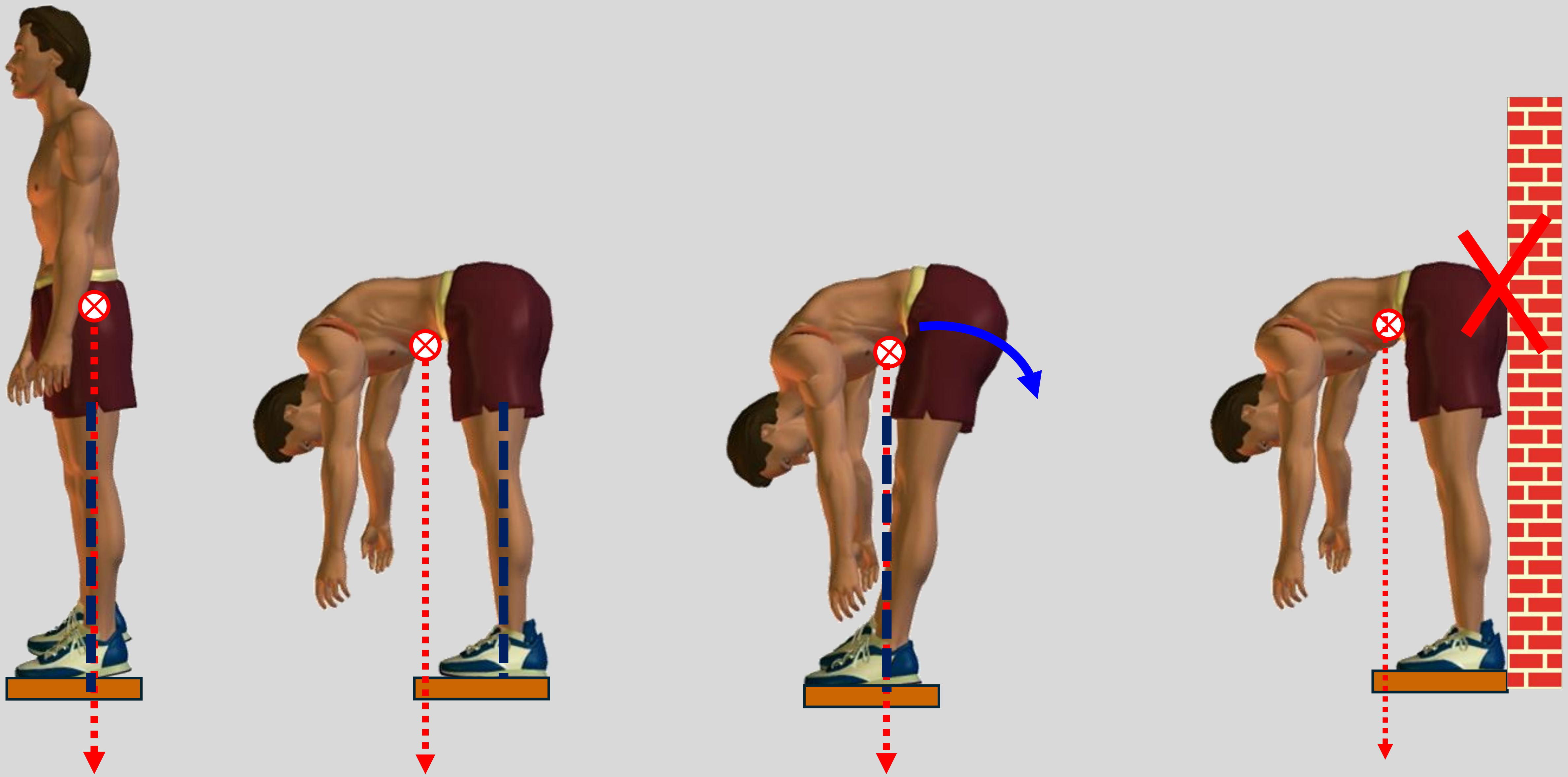


Dank voor uw aandacht

Zwaartepunt en Steunvlak 1

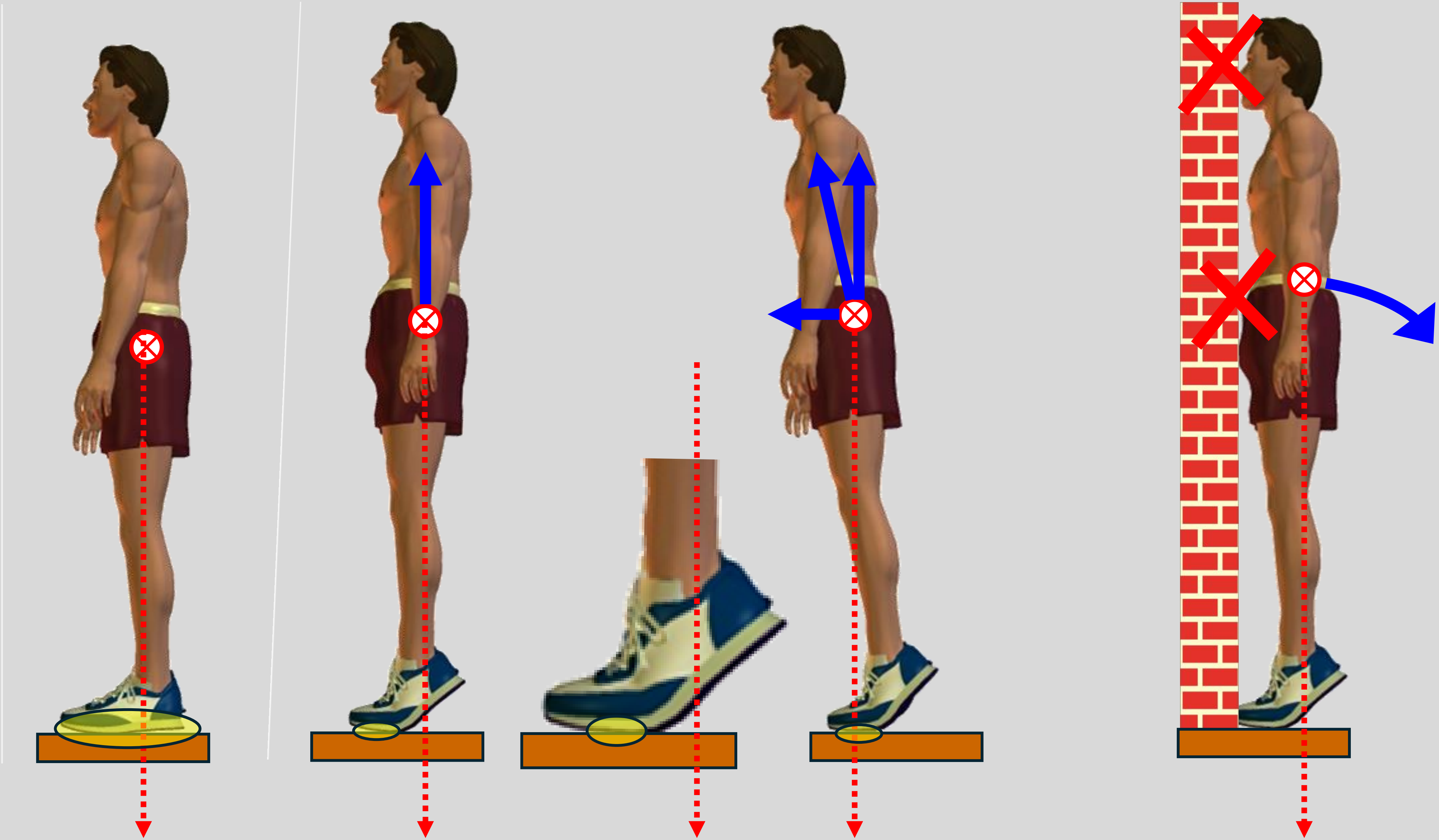


Zwaartepunt en Steunvlak 1: verklaring

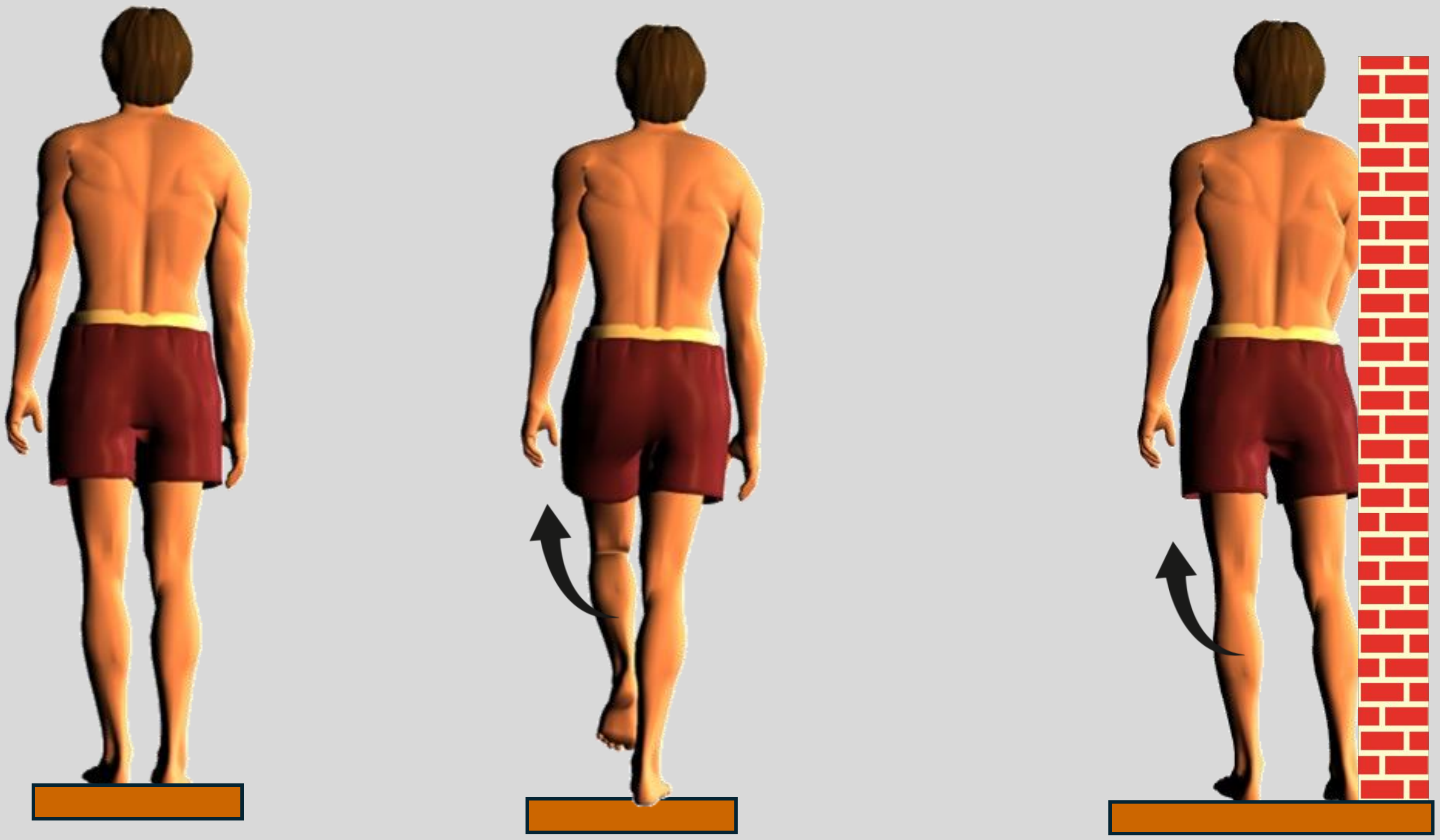


Zwaartepunt en Steunvlak 2

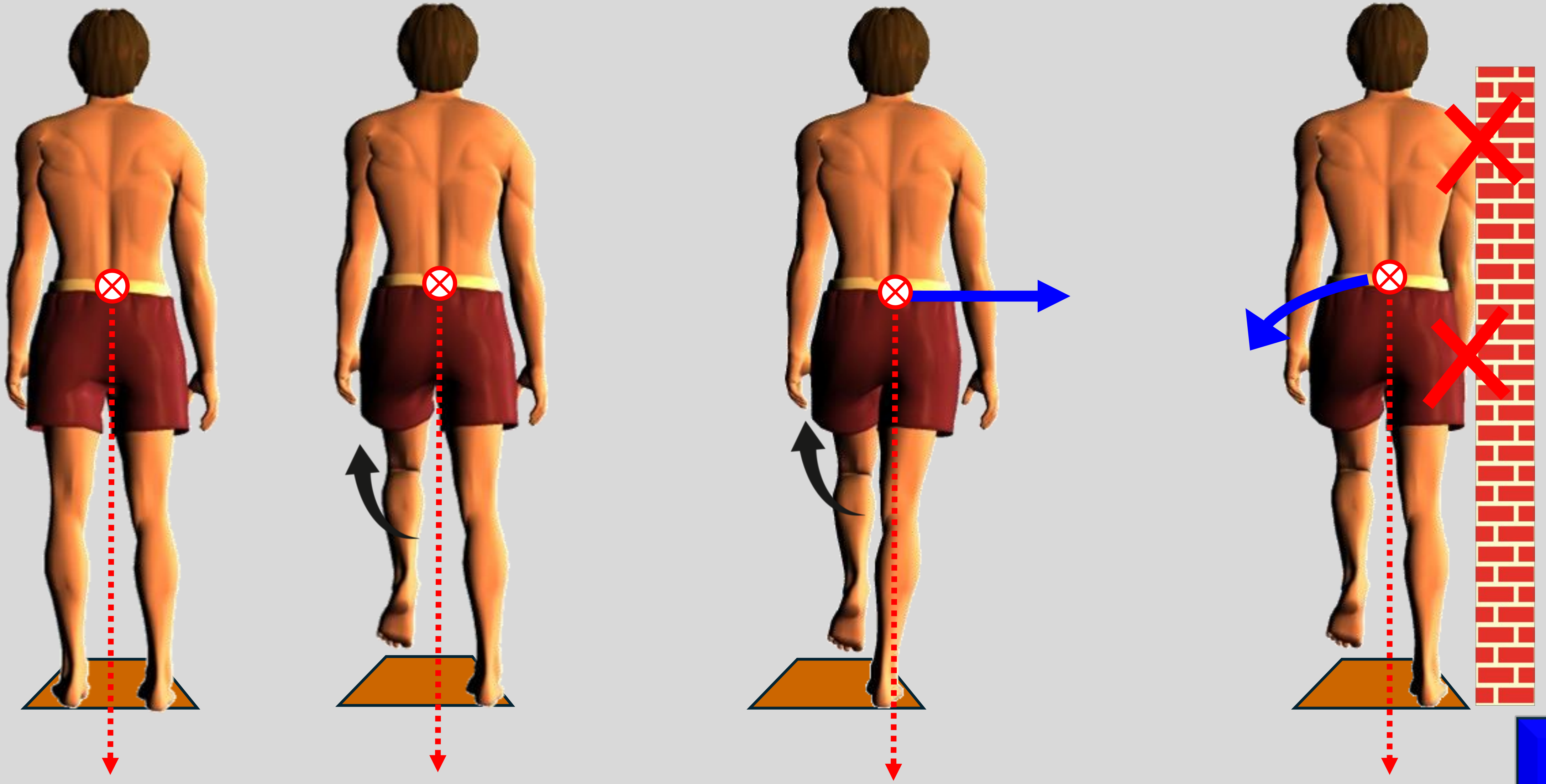
Zwaartepunt en Steunvlak 2: verklaring



Zwaartepunt en Steunvlak 3



Zwaartepunt en Steunvlak 3: verklaring



Physiologie des mouvements

Fys.doorsnede: 12 cm^2

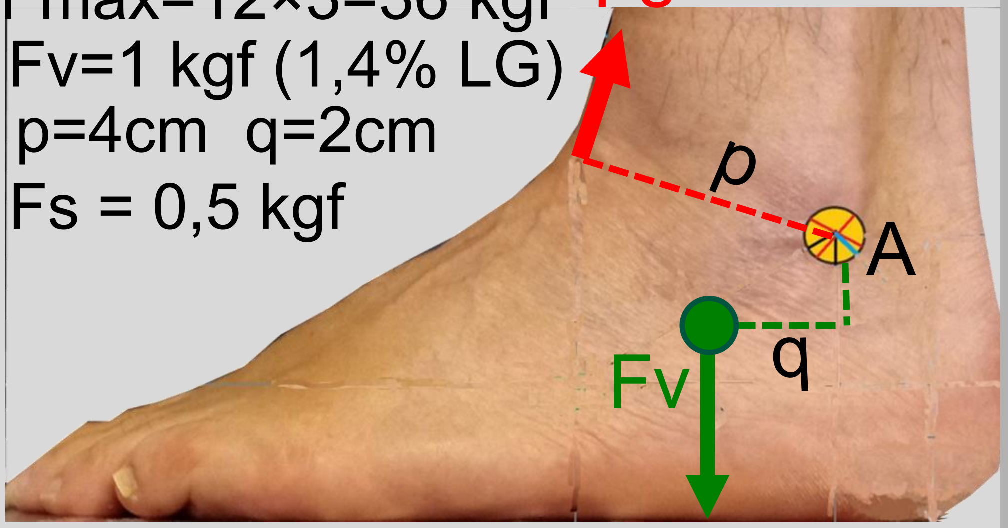
Fspecifiek: 3 kgf/cm^2

Fmax=12×3=36 kgf

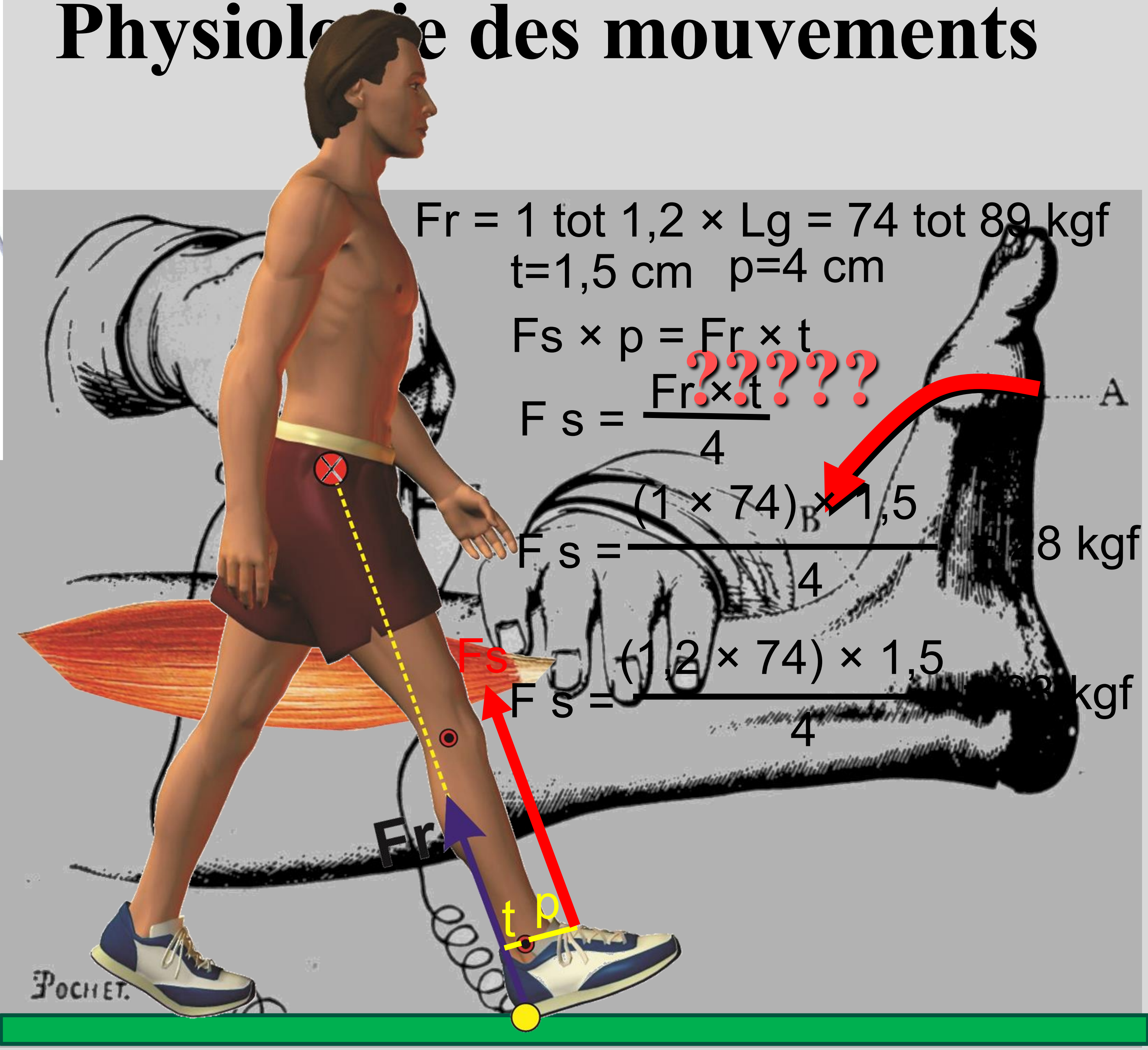
Fv=1 kgf (1,4% LG)

p=4cm q=2cm

Fs = 0,5 kgf



Fmax is 72 × groter dan Fv



Fr = 1 tot 1,2 × Lg = 74 tot 89 kgf

t=1,5 cm p=4 cm

$F_s \times p = F_r \times t$

??????

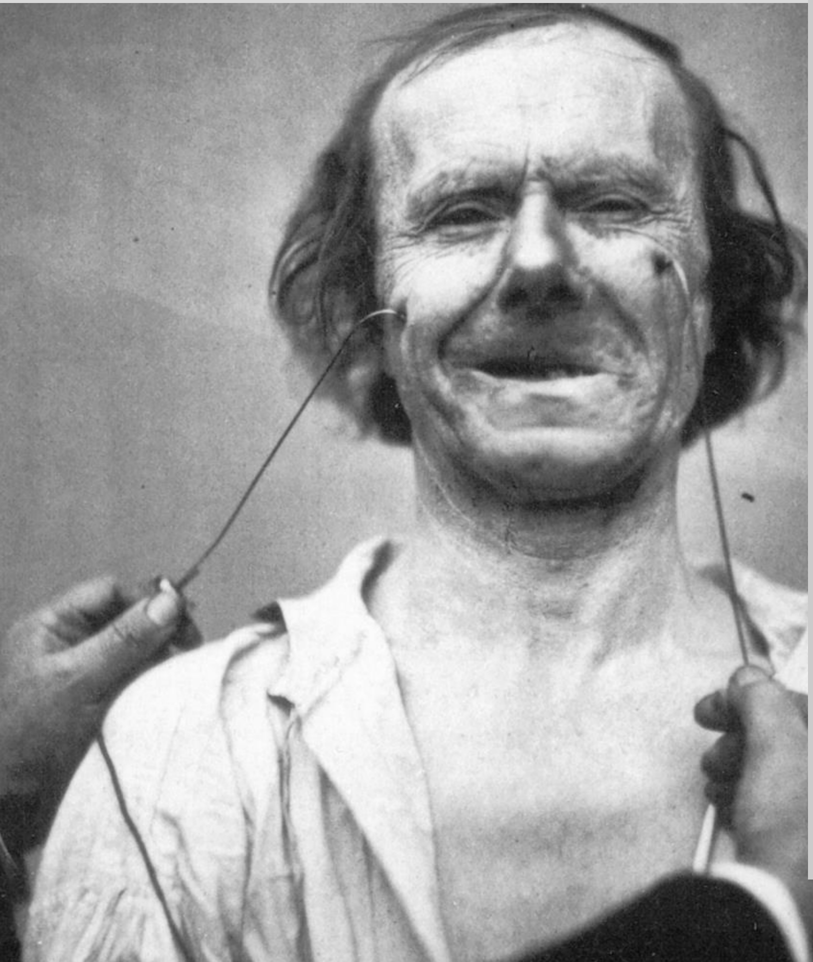
$F\,s = \dfrac{Fr \times t}{4}$

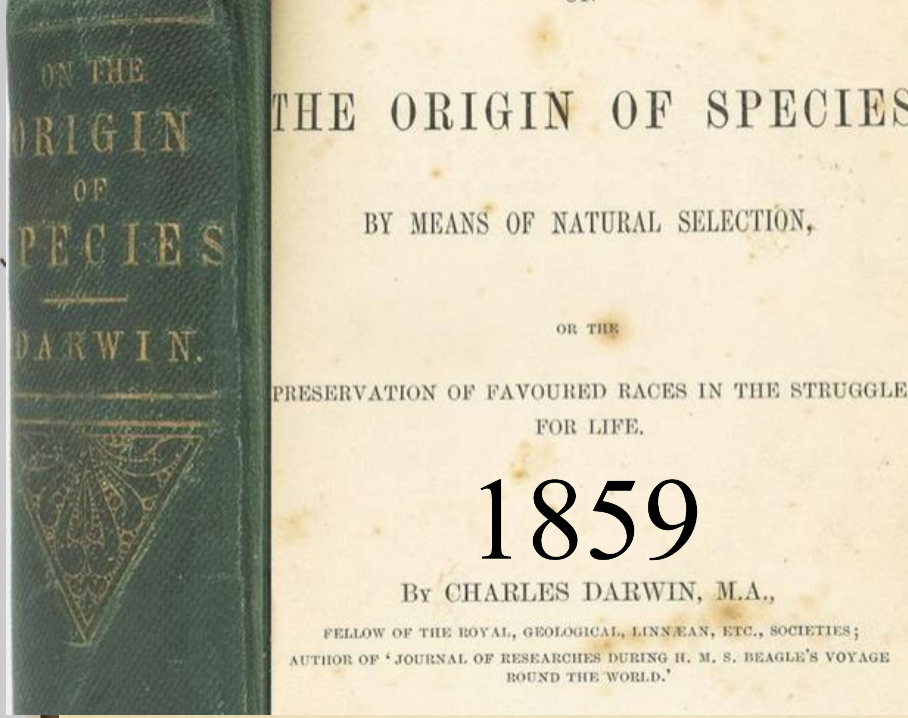
$F\,s = \dfrac{(1 \times 74) \times 1{,}5}{4}$ = 28 kgf

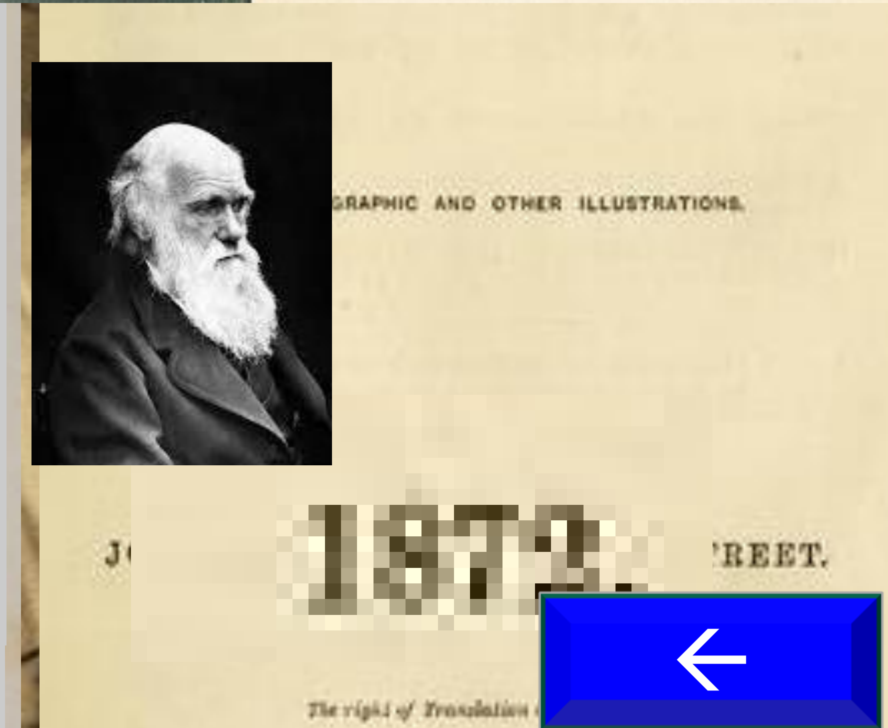
$F\,s = \dfrac{(1{,}2 \times 74) \times 1{,}5}{4}$ = 33 kgf

Guillaume-Benjamin Duchenne de Boulogne

1806-1875 Mécanisme de la physionomie humaine **ou analyse électrophysiologique de l'expression des passions.**







- *parese/paralyse van de heupabductoren;*

Foramen suprapiriformis

L4

N. gluteus superior

M. piriformis

L5

M. gluteus minimus

M. gluteus medius

S1

M. tensor fascia latae

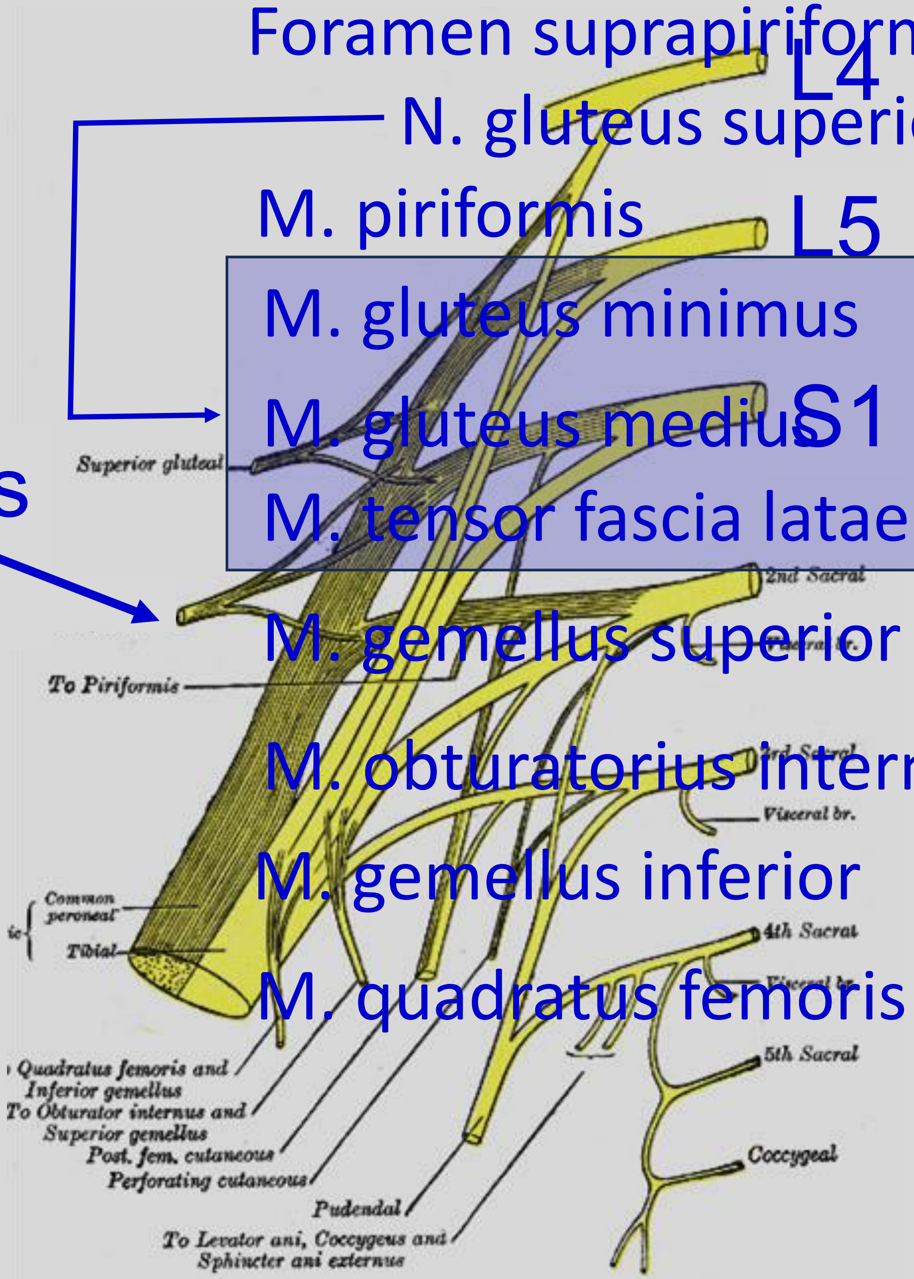
N. gluteus superior

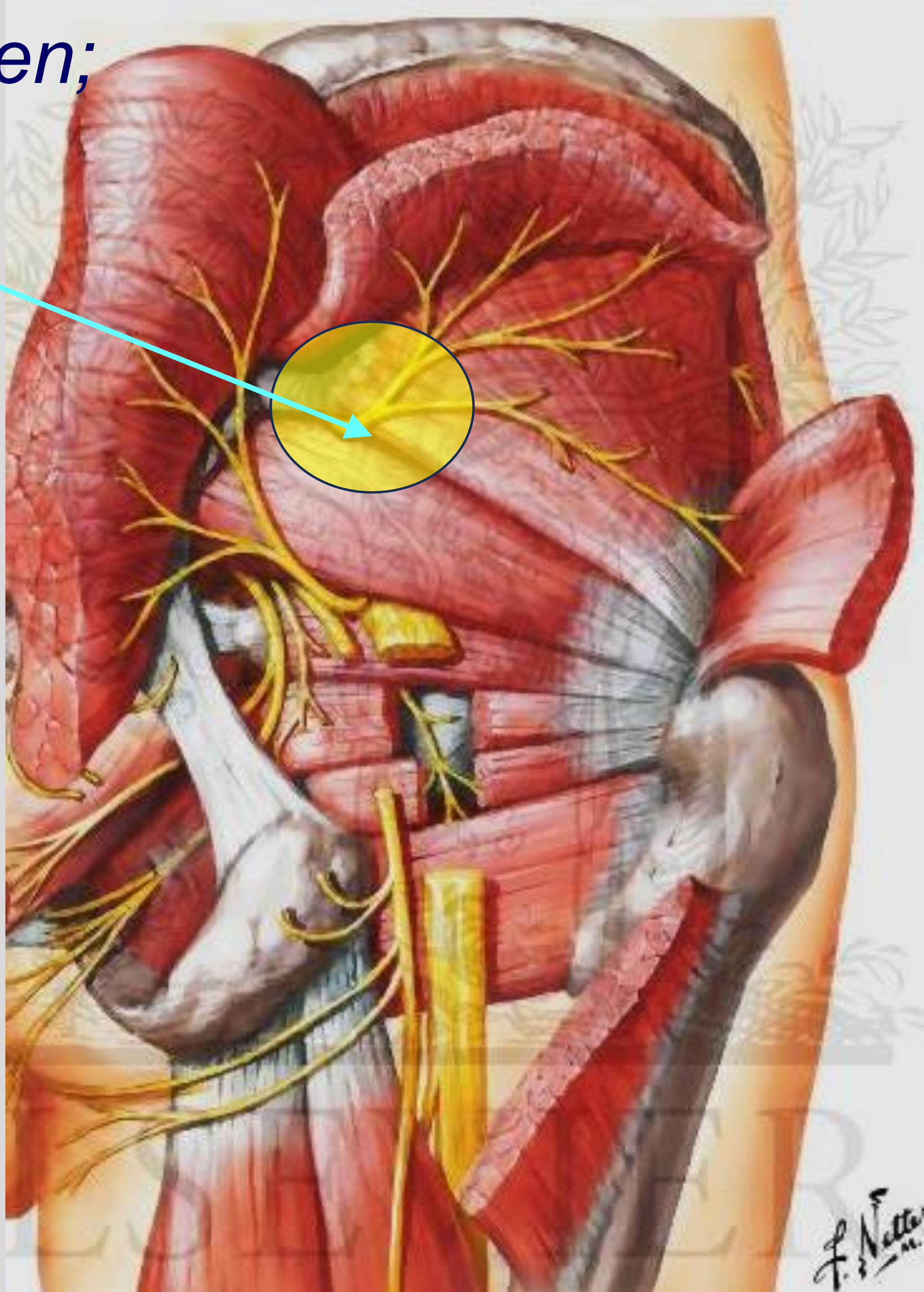
M. gemellus superior

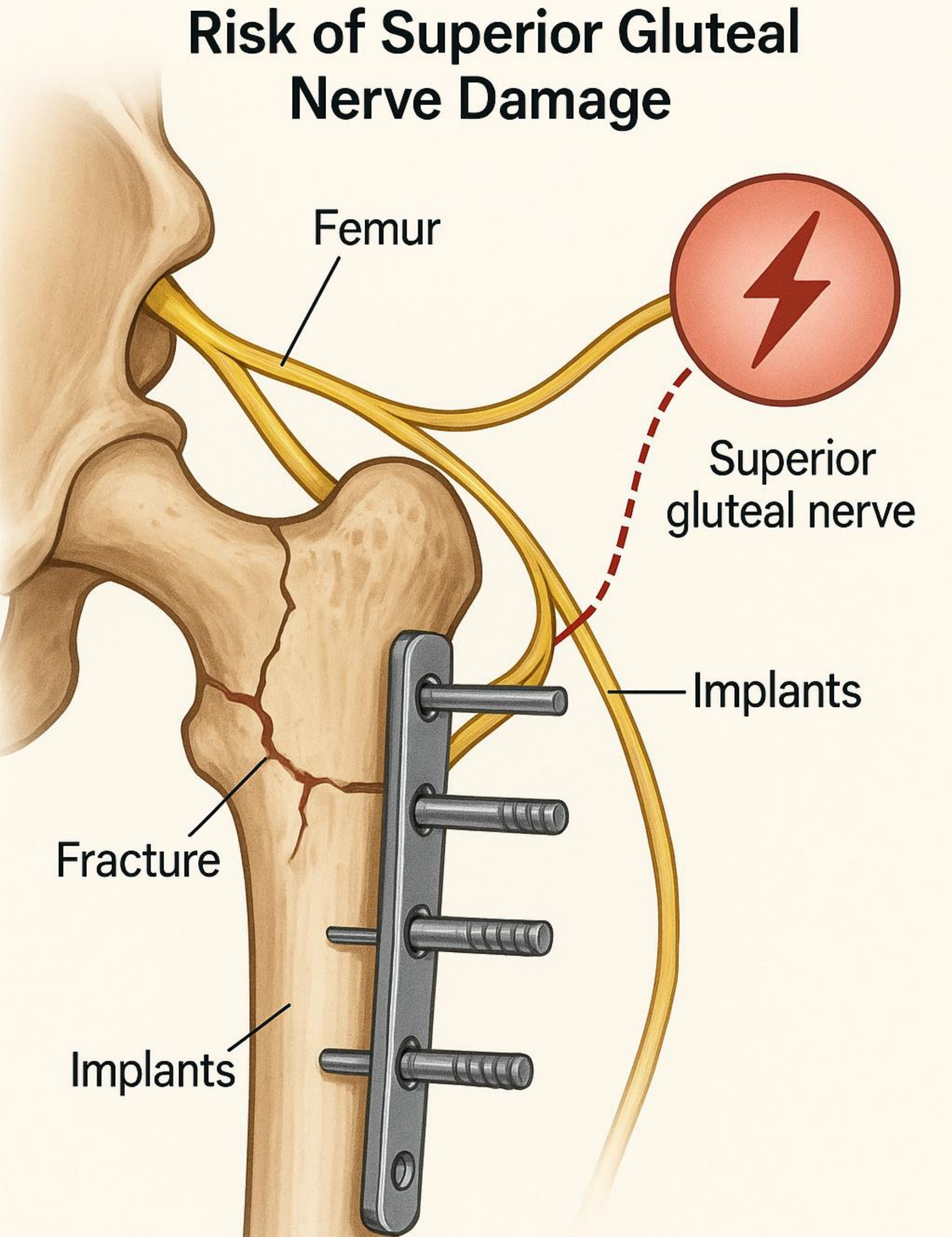
M. obturatorius internus

M. gemellus inferior

M. quadratus femoris







Vraag het AI:

Laat in één plaatje zien hoe het inbrengen van pennen, platen en schroeven in het femur bij een fractuur, kan leiden tot een beschadiging van de N. gluteus superior

Perplexity

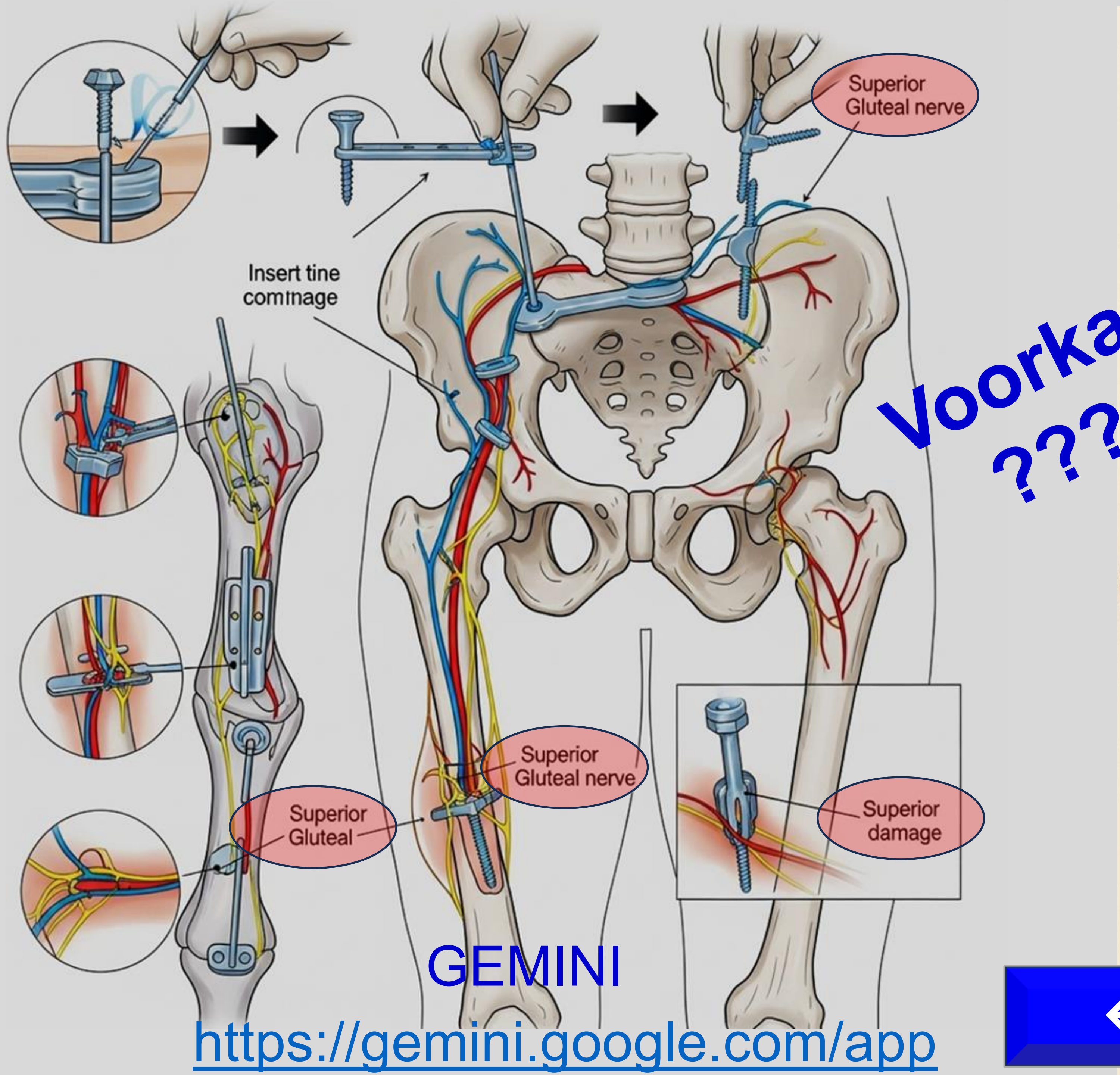
https://www.perplexity.ai/search/laat-in-1-plaatje-zien-hoe-het-bgELOzUbTKGOX4mEa2ERkg

AI Image Generator

https://deepai.org/machine-learning-model/text2img

Ideogram

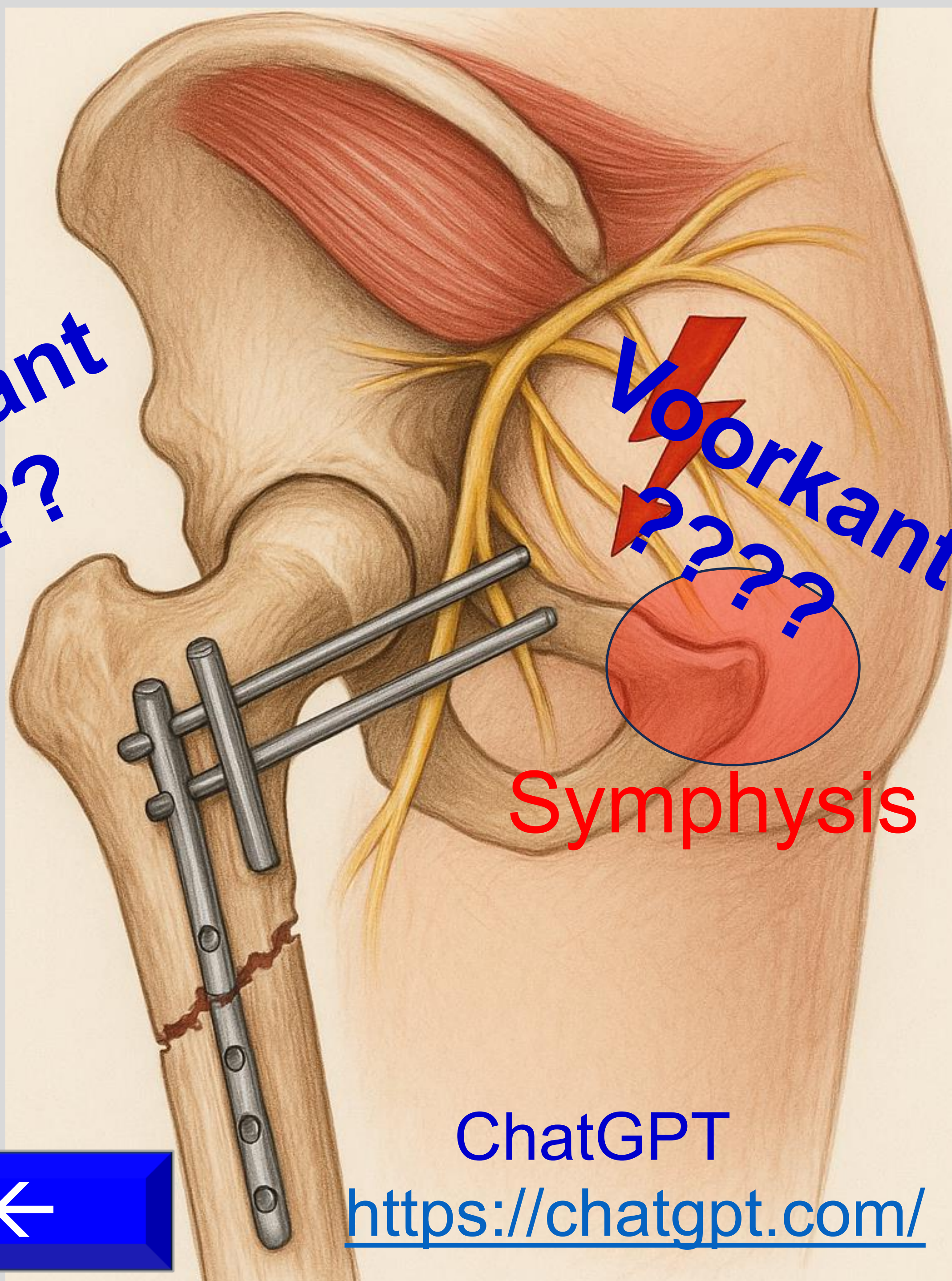
https://ideogram.ai/t/explore



Voorkant
????

GEMINI

https://gemini.google.com/app

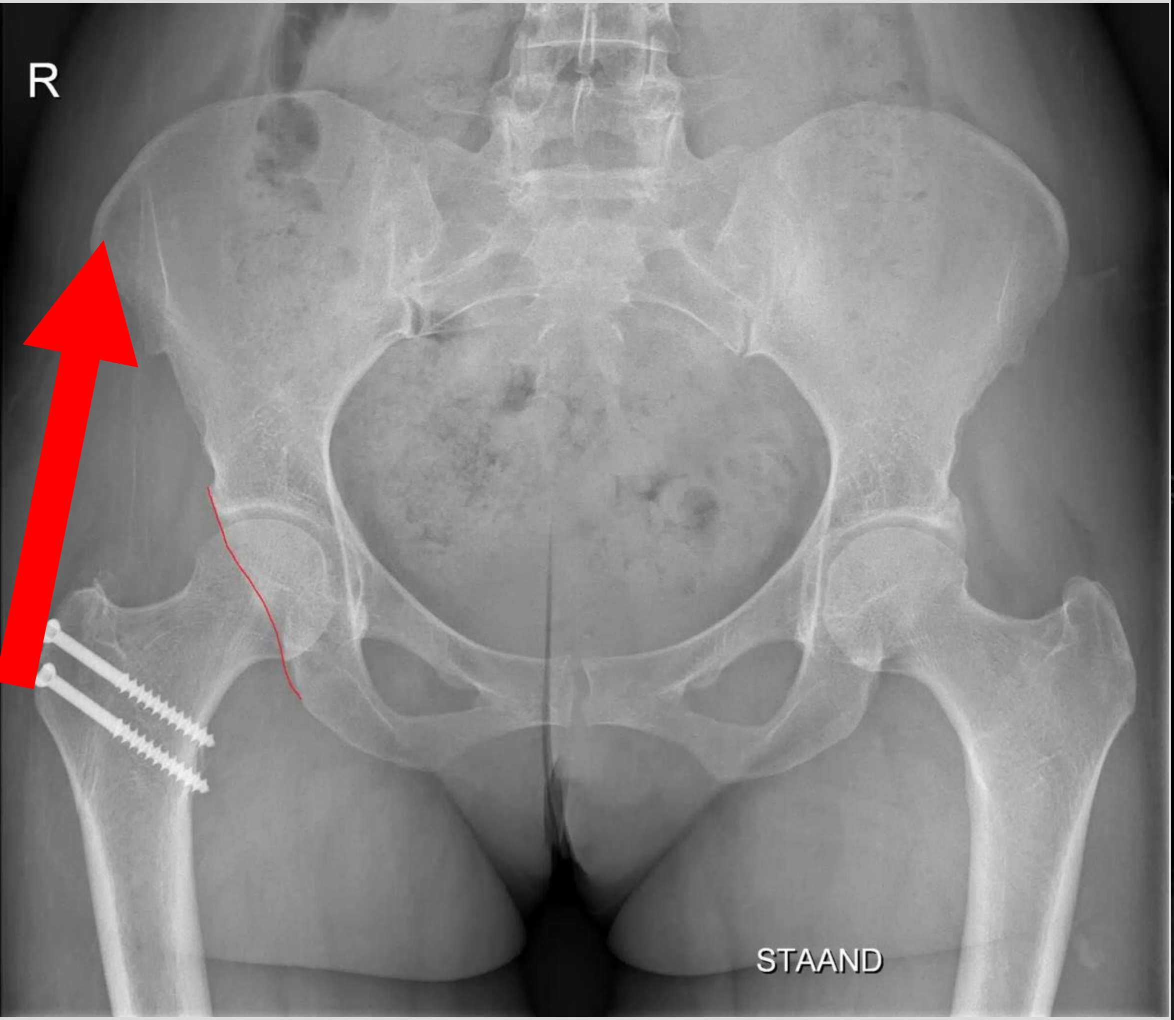


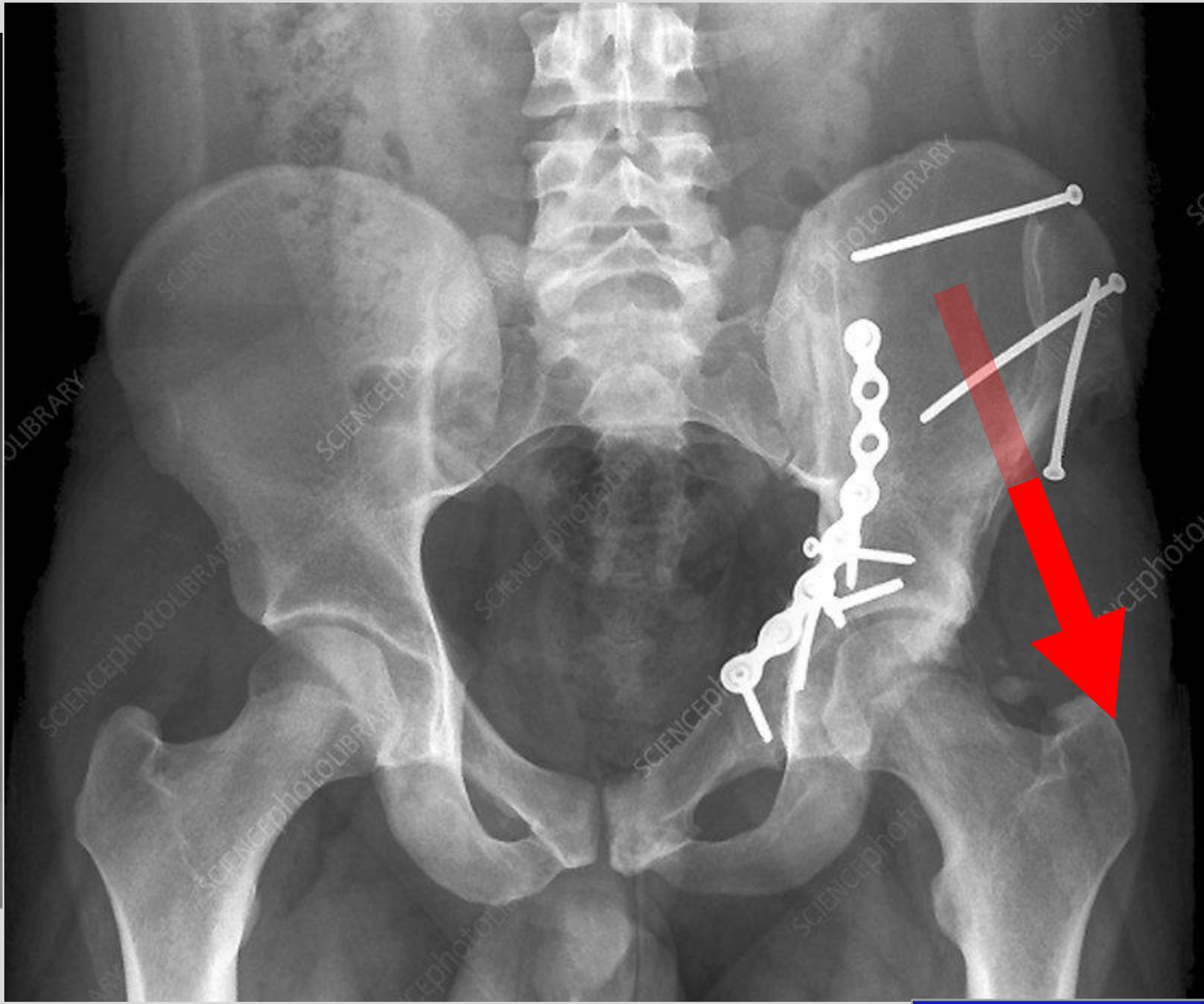
ChatGPT

https://chatgpt.com/

←

- *beschadiging heupabductoren → contractie pijnlijk;*





https://www.azlink.be/artikel/azlink-38/de-jonge-patient-met-heupklachten-evolutie-naar-heupsparende-chirurgie/

https://www.sciencephoto.com/media/90743/view/pinned-hip-fractures-x-ray

←

Subchondrale cysten en de intra-ossale veneuze hypertensie

Trueta J.
The Hip
The Hip society.
The C.V. Mosby Company (1973).

J. Trueta
Studies on the development
and decay of the human frame
William Heinemann Medical Books (1968)

Arnoldi C. Impeded Venous Drainage from the Bone Marrow of the Femoral Head: A Synthesis. Vascular Surgery 24(2):97-106 (1990).

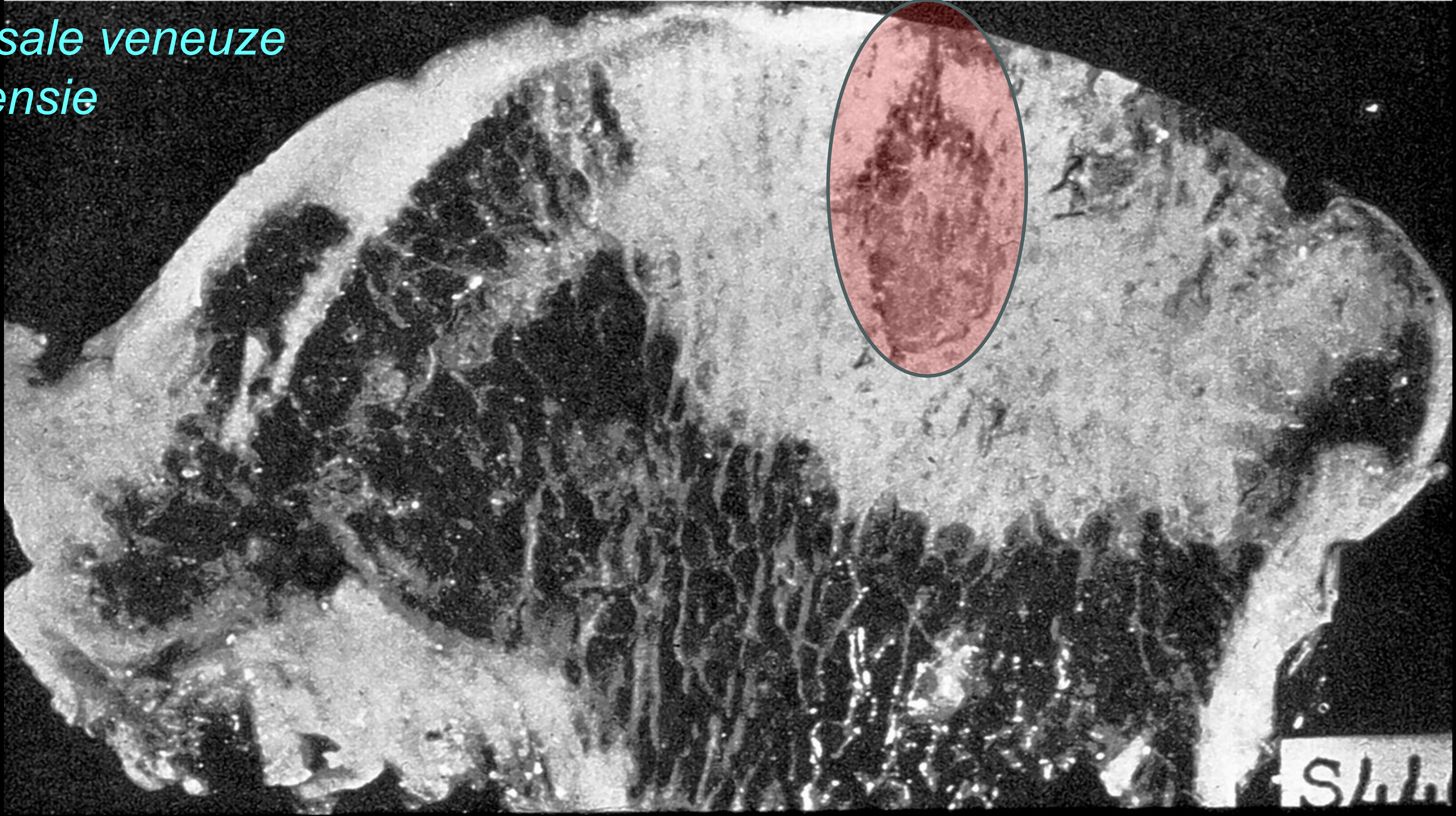
Carl Arnoldi, Hakan Linderholm, Herbert Mussbichler,
Venous engorgement and intraosseous hypertension
in osteoarthritis of the hip.
The Journal Of Bone And Joint Surgery
54b, no. 3, august 1972

Arnoldi C. Intraosseus Hypertension
Clinical Orthopaedics and Related Research, nr.115
(1976), pp.30-34.

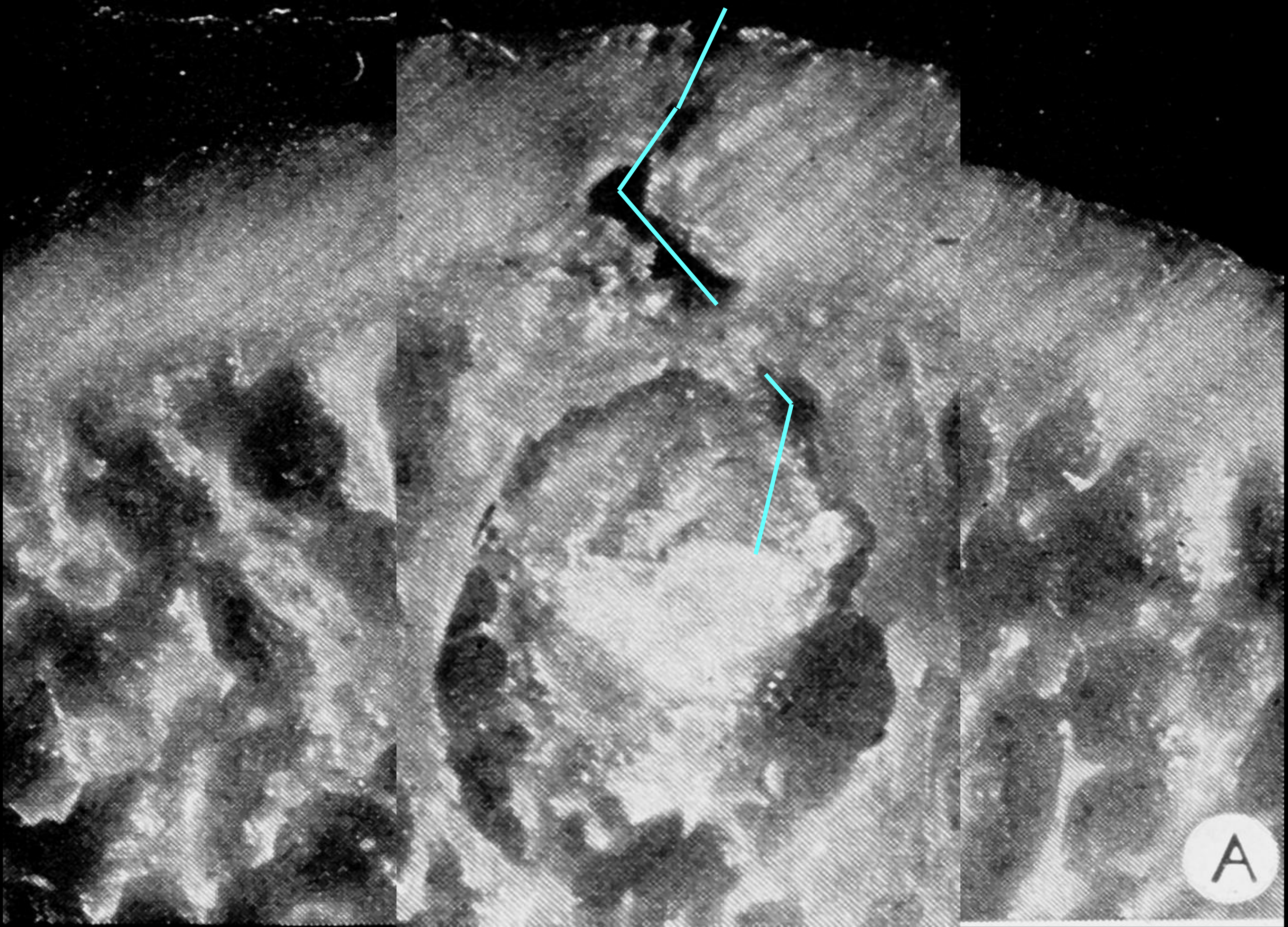
- Osteoarthritic cyst
- Pseudocyst
- Geode
- Subchondral cyst
- Egger cyst (in the hip socket)

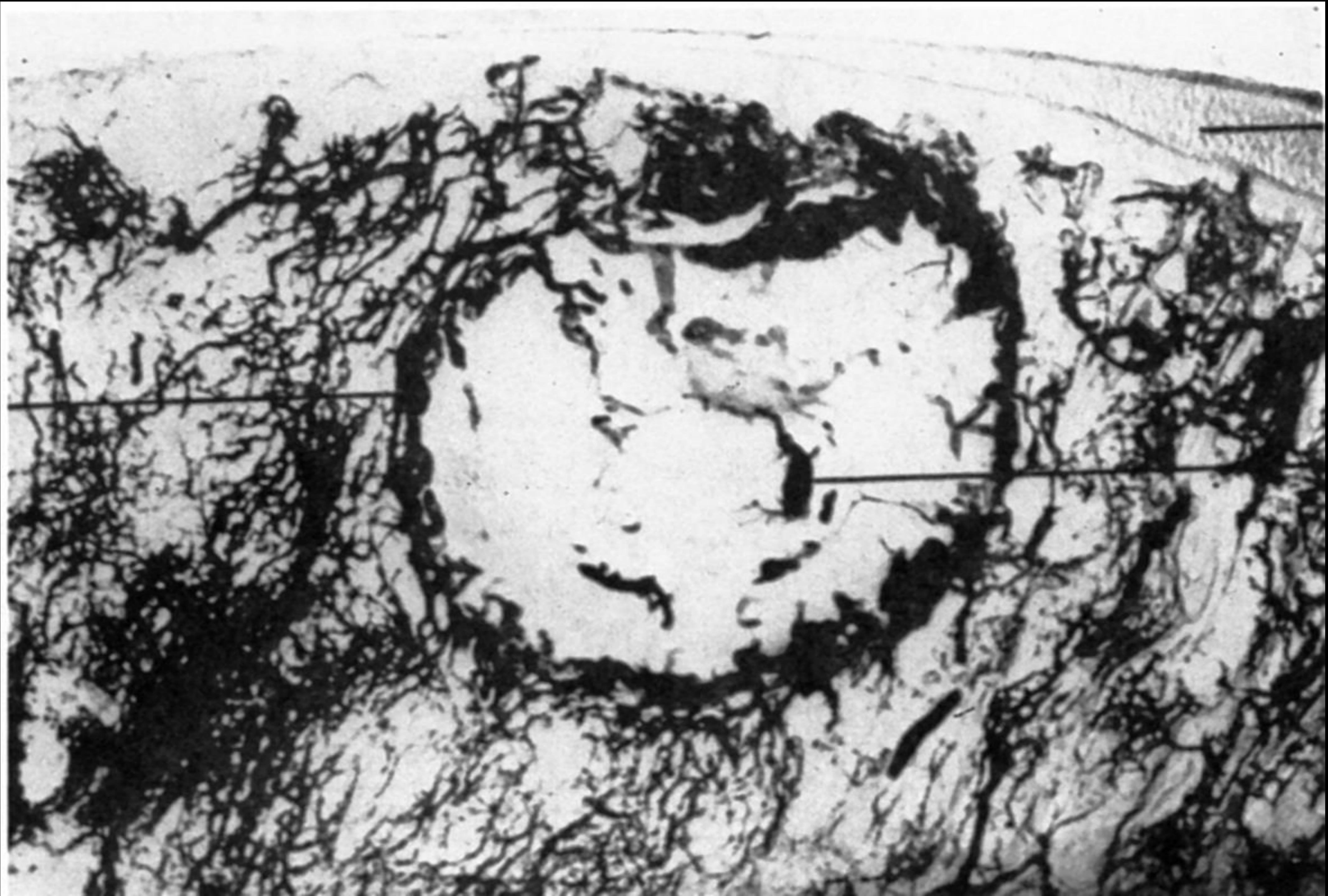
https://prod-images-static.radiopaedia.org/images/2144714/c408827b5952b03b9eb044101a5141.jpg

Intraossale veneuze hypertensie



Naar: J. Hollander Arthritis and Allied Conditions

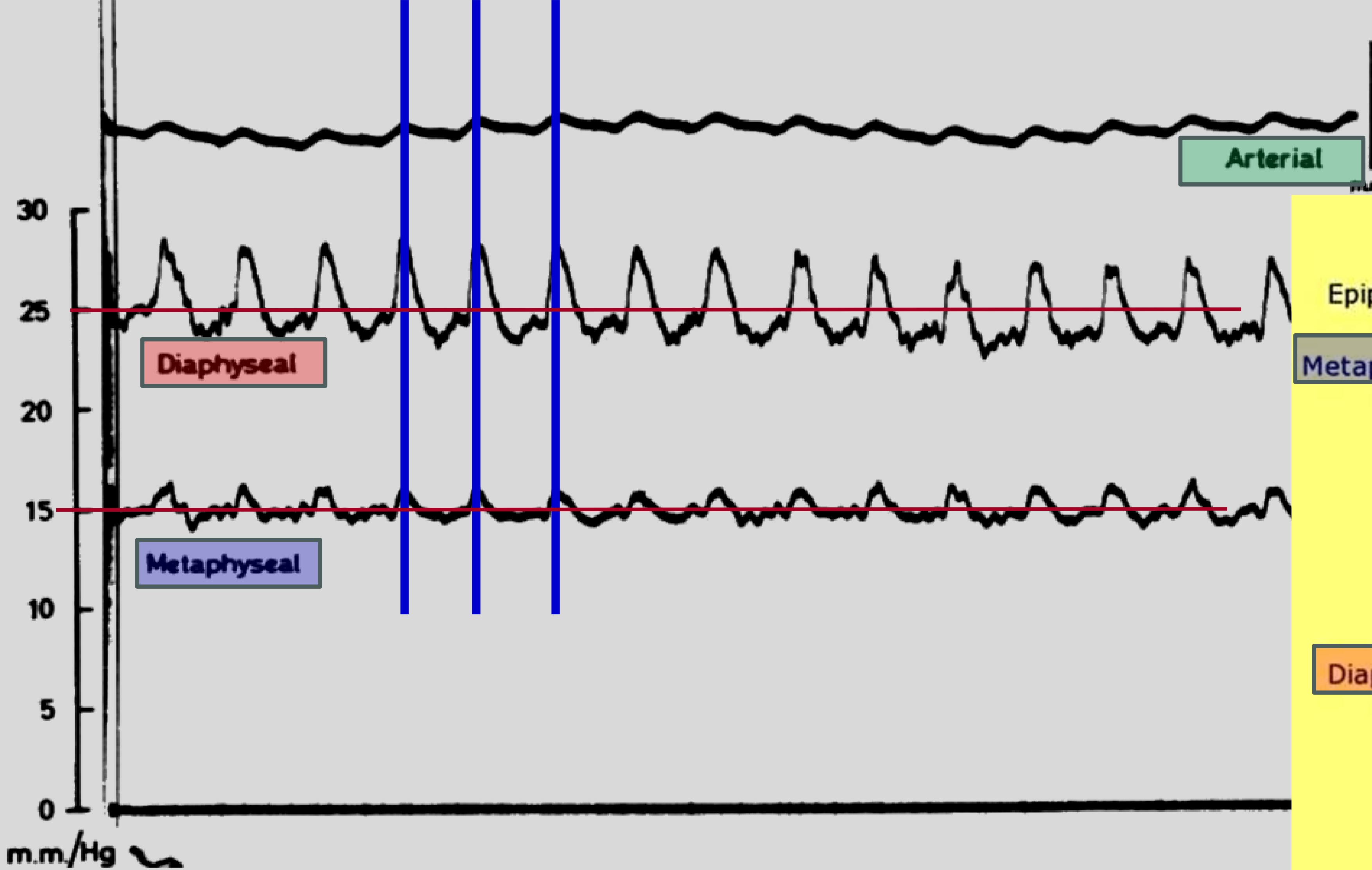

A

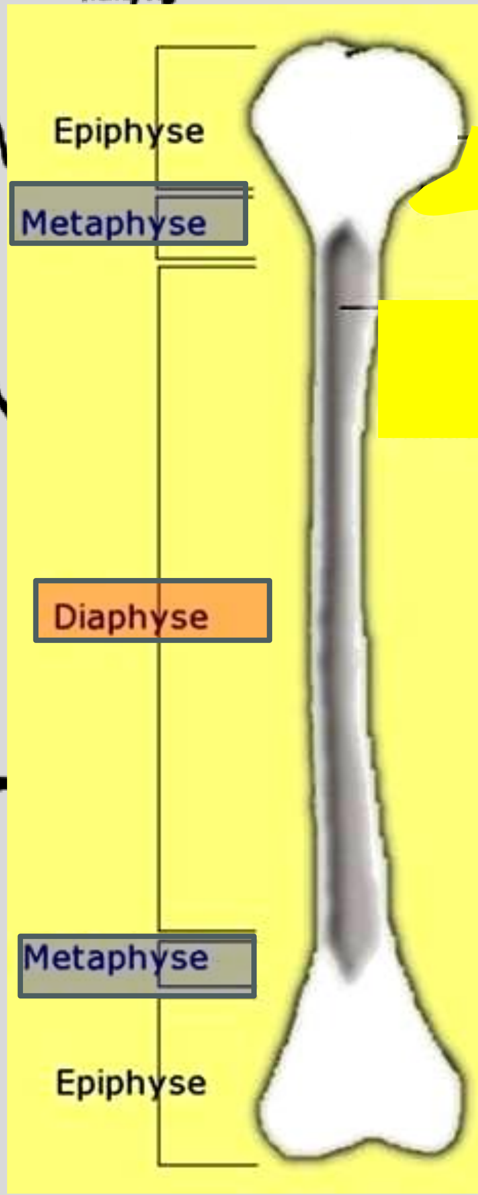


Trueta J. in:
The Hip
The Hip society.
The C.V. Mosby
Company (1973).

Intra-ossale
veneuze
bloeddruk

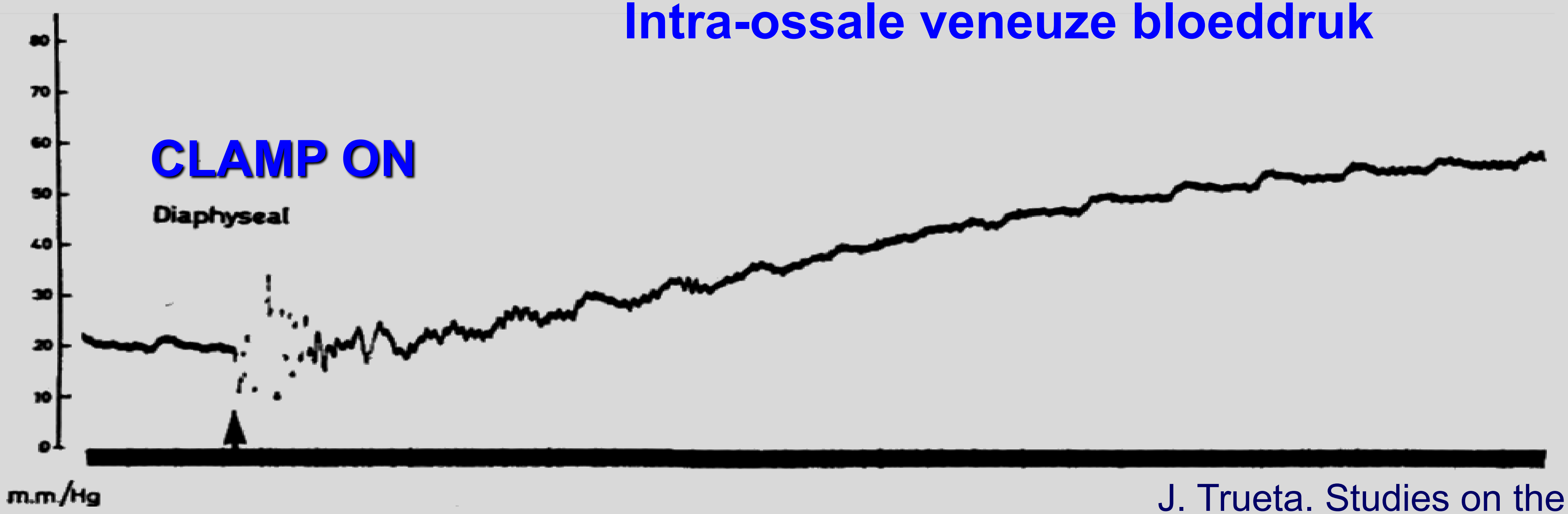
Gem. Dia- en
Meta-physe:
(25 + 15) / 2 =
20 mm Hg



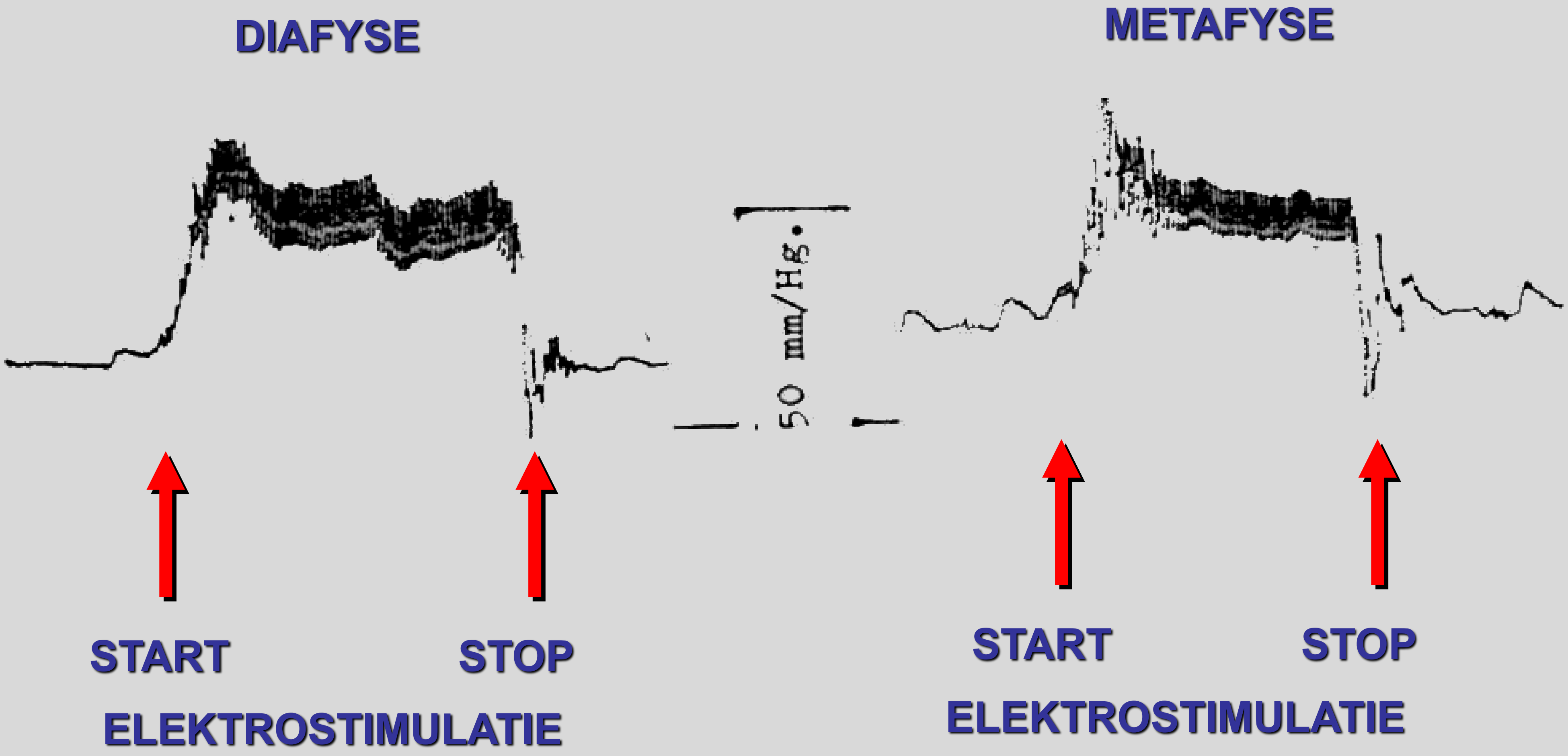


Naar J. Trueta
Studies on the development
and decay of the human frame
William Heinemann Medical Books (1968)

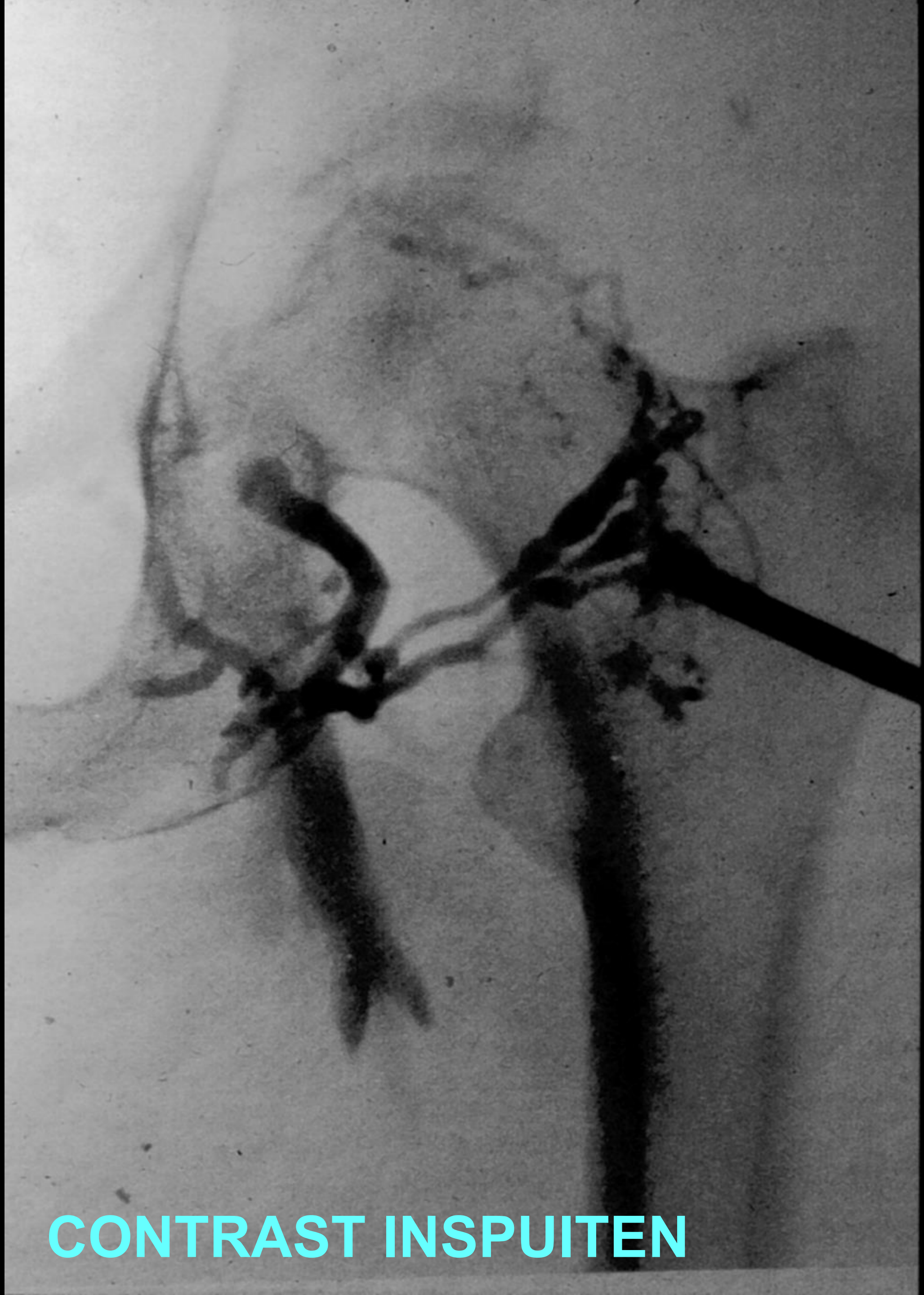
Intra-ossale veneuze bloeddruk



J. Trueta. Studies on the development and decay of the human frame. William Heinemann Medical Books (1968)



J. Trueta. Studies on the development and decay of the human frame. William Heinemann Medical Books (1968)

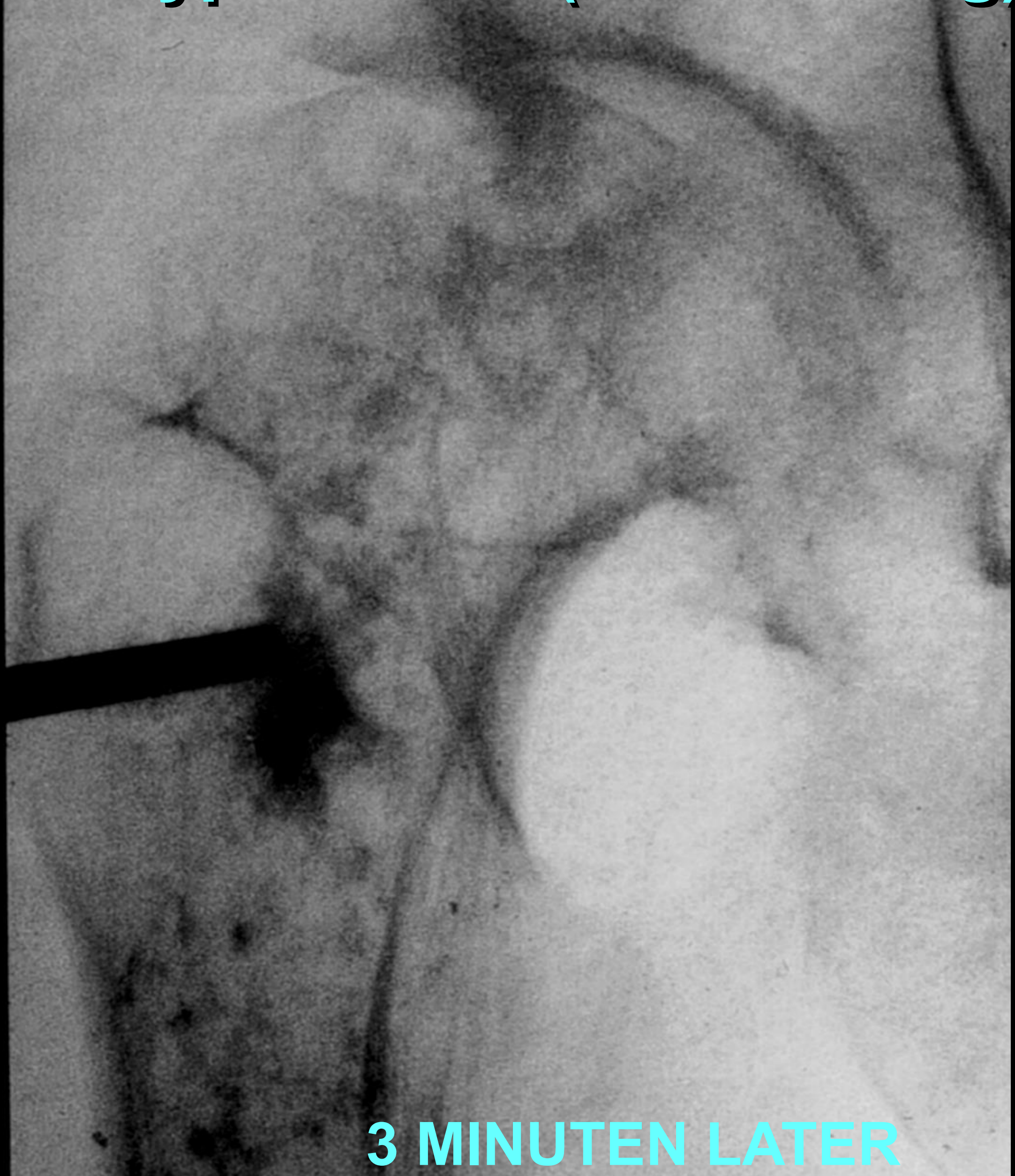

CONTRAST INSPUITEN

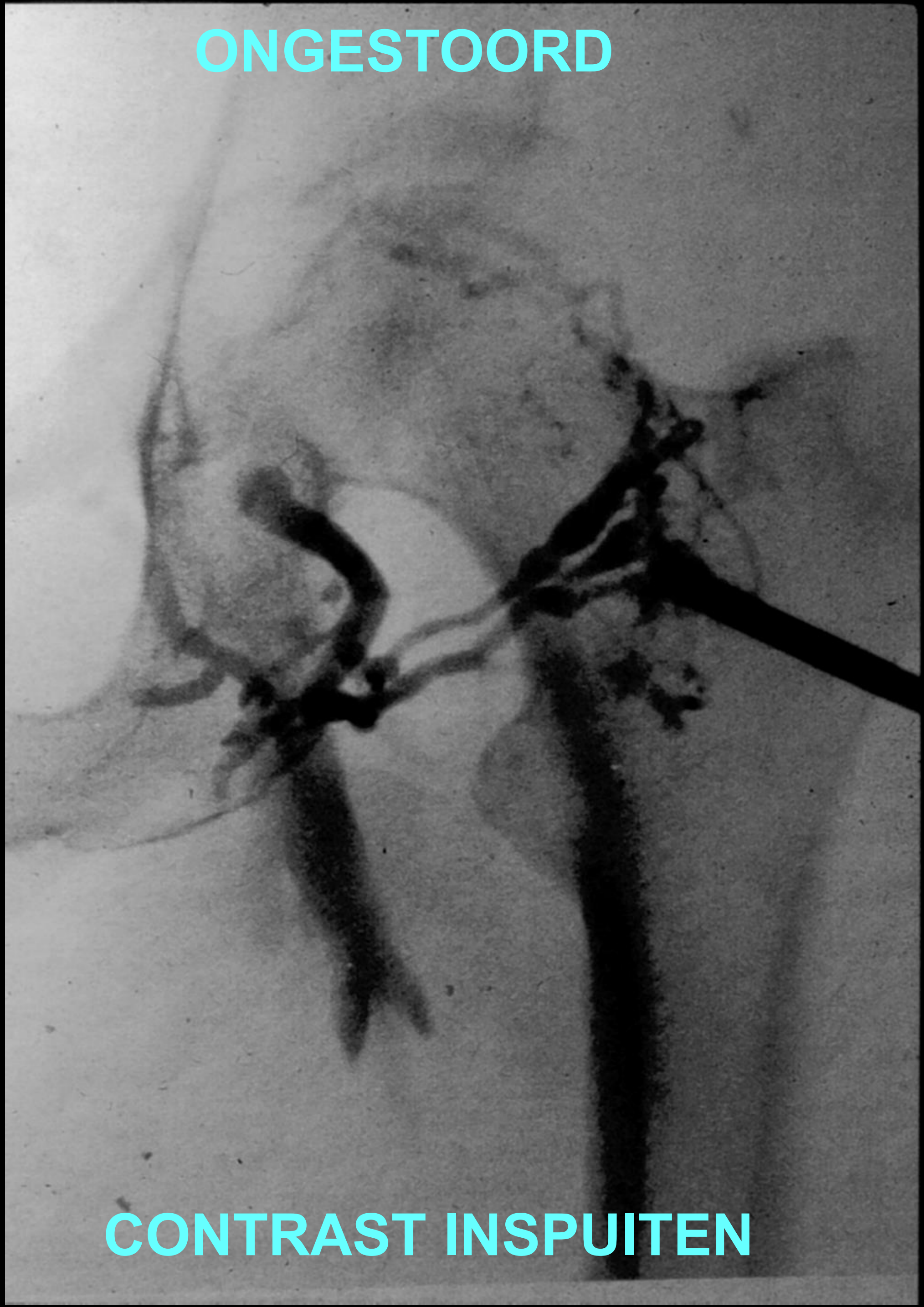
ONGESTOORD


Intra-ossale veneuze druk:
ca 20 mm Hg
3 MINUTEN LATER

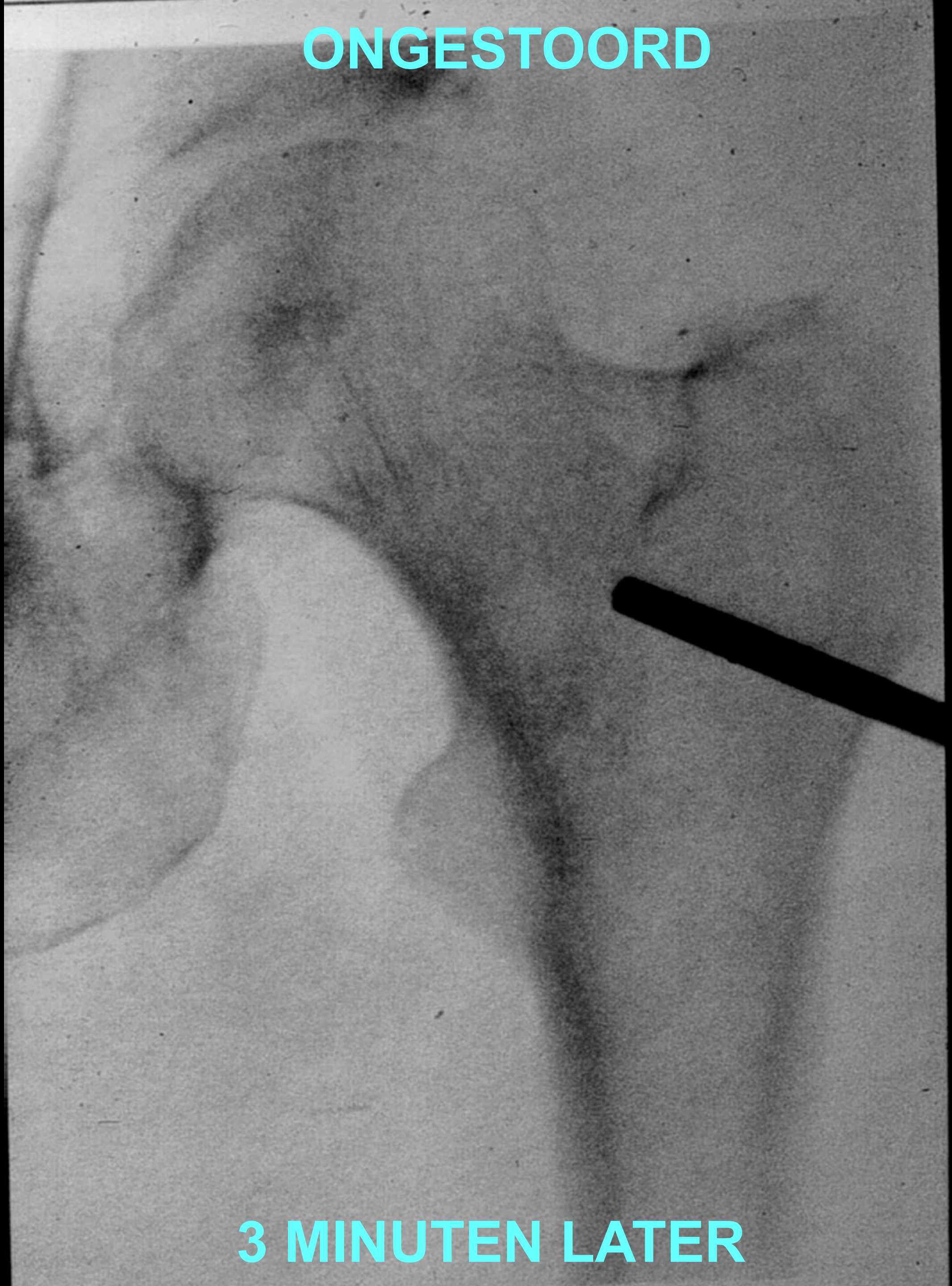
Intra-ossale veneuze hypertensie (> 40 mm Hg)

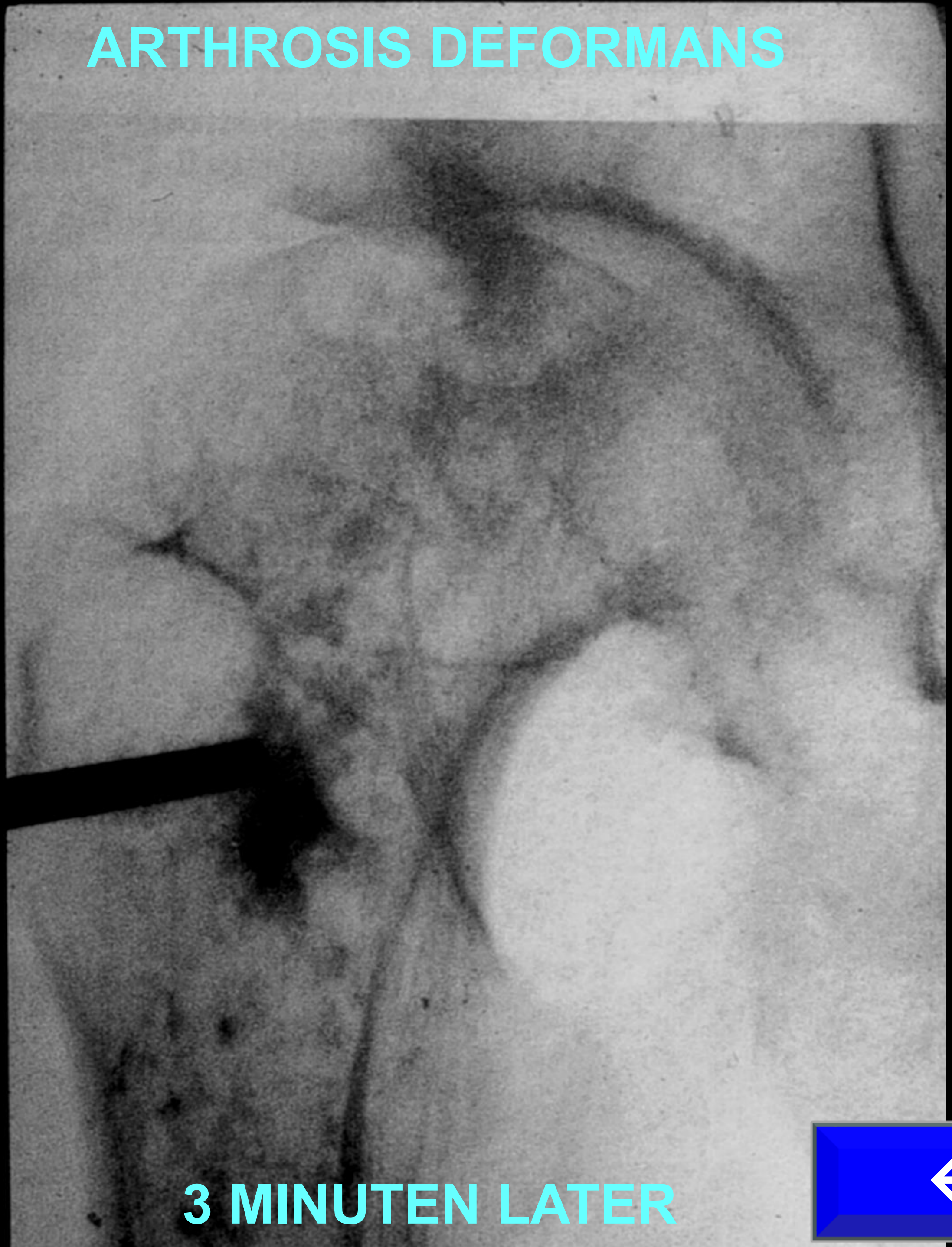
ARTHROSIS DEFORMANS

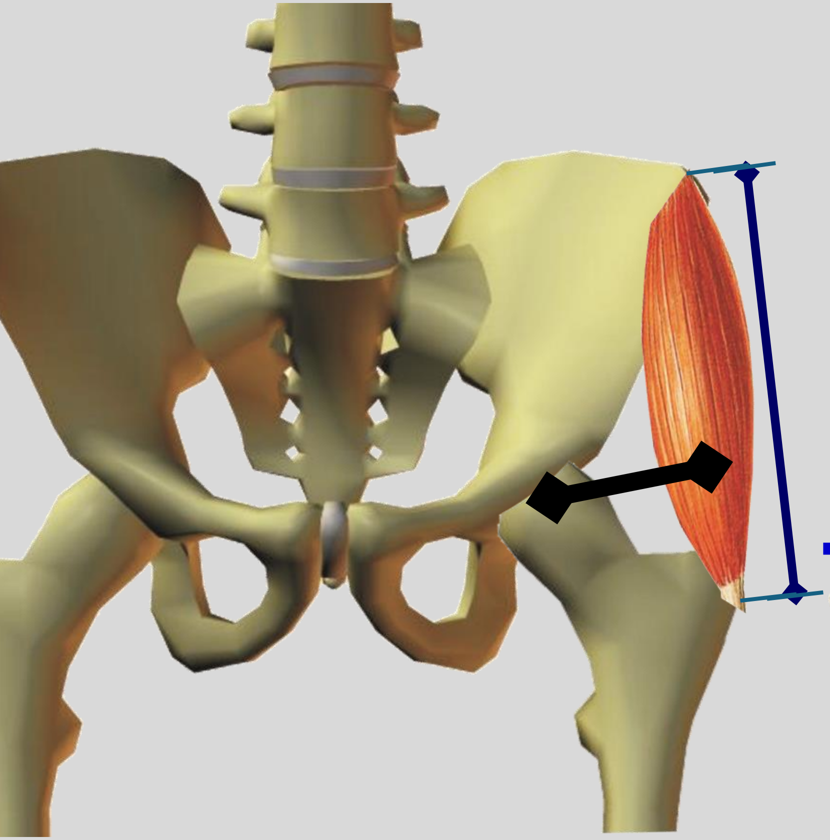



ONGESTOORD
CONTRAST INSPUITEN

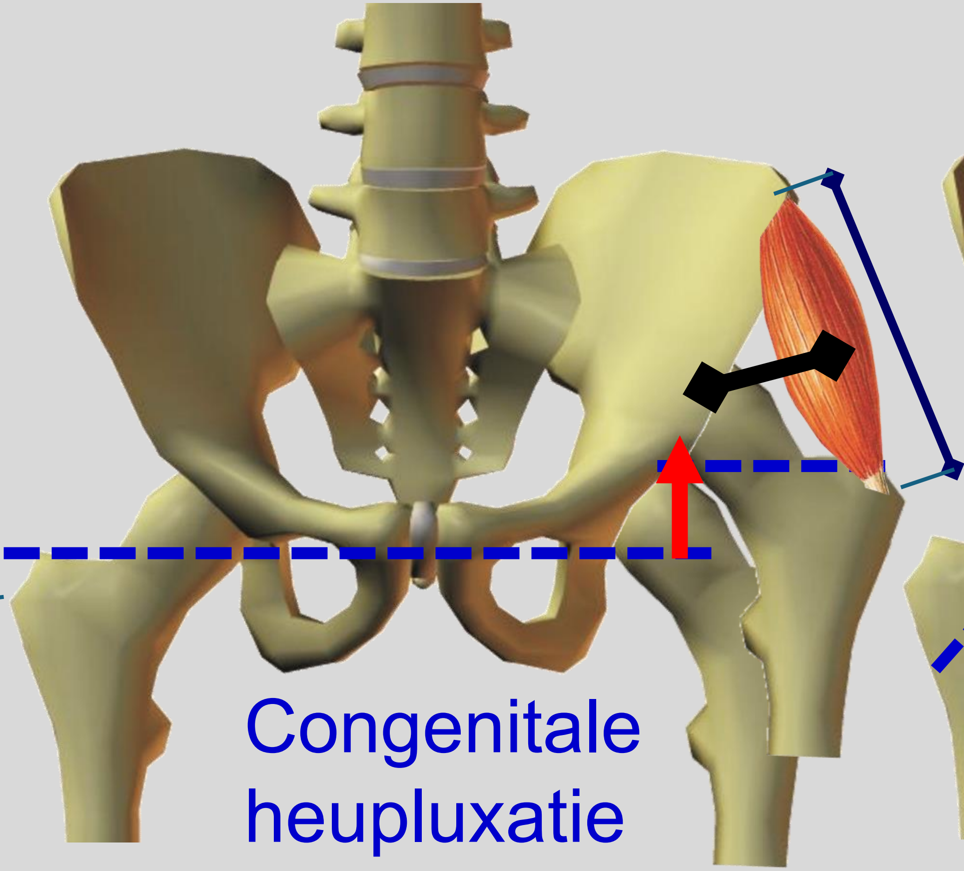

ARTHROSIS DEFORMANS
R
CONTRAST INSPUITEN


ONGESTOORD
3 MINUTEN LATER


ARTHROSIS DEFORMANS
3 MINUTEN LATER

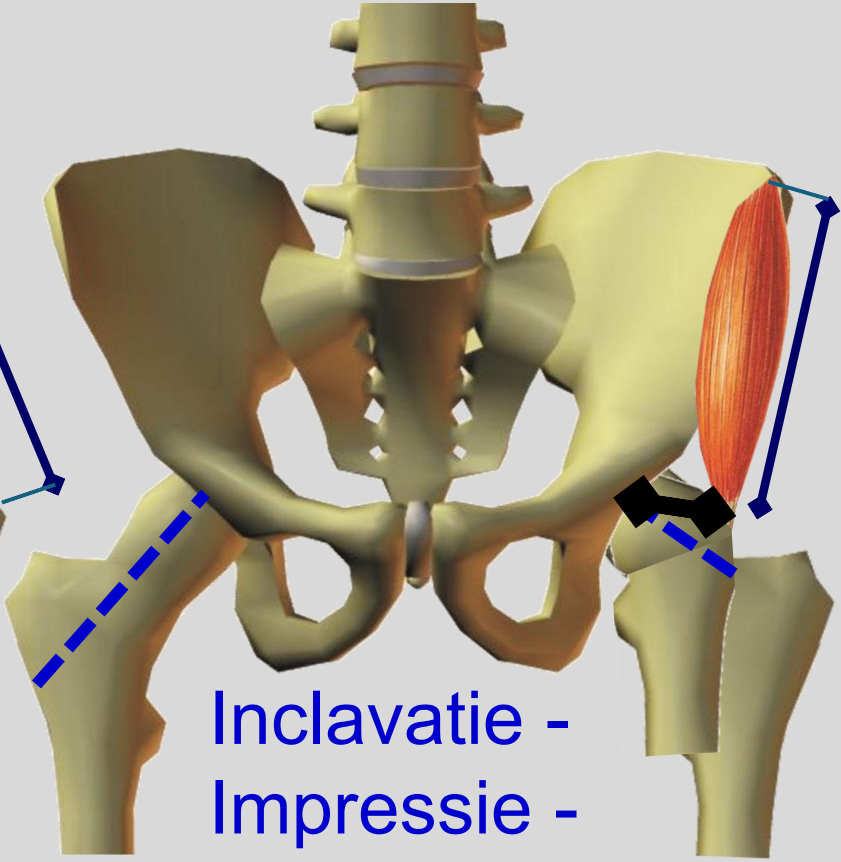


Vermindering van de origo-insertie-afstand en/of verkleining van de momentsarm



Congenitale heupluxatie

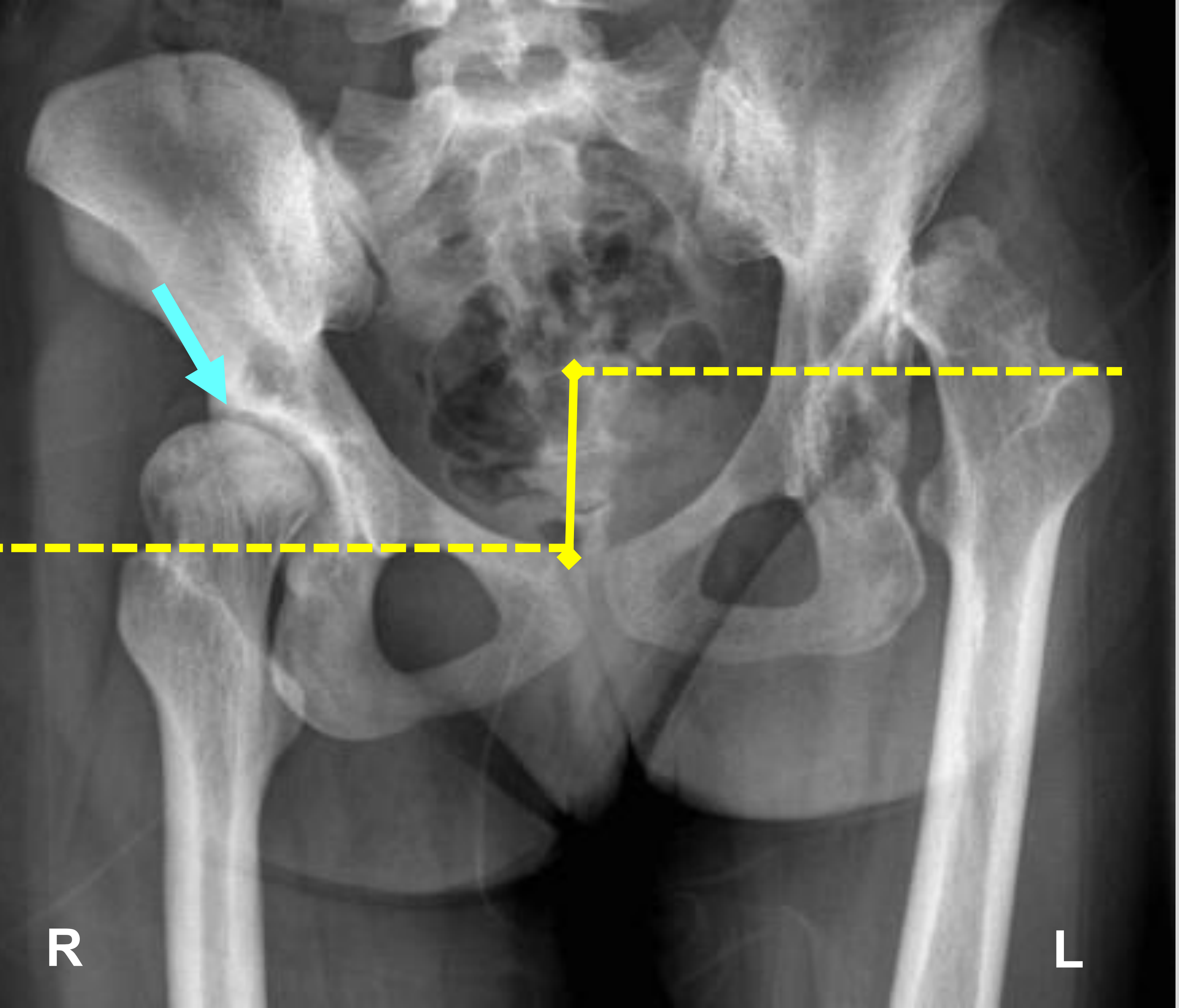
Spiervezels korter



Inclavatie - Impressie - Invaginatie - fractuur

Momentsarm kleiner

Spiervezels korter



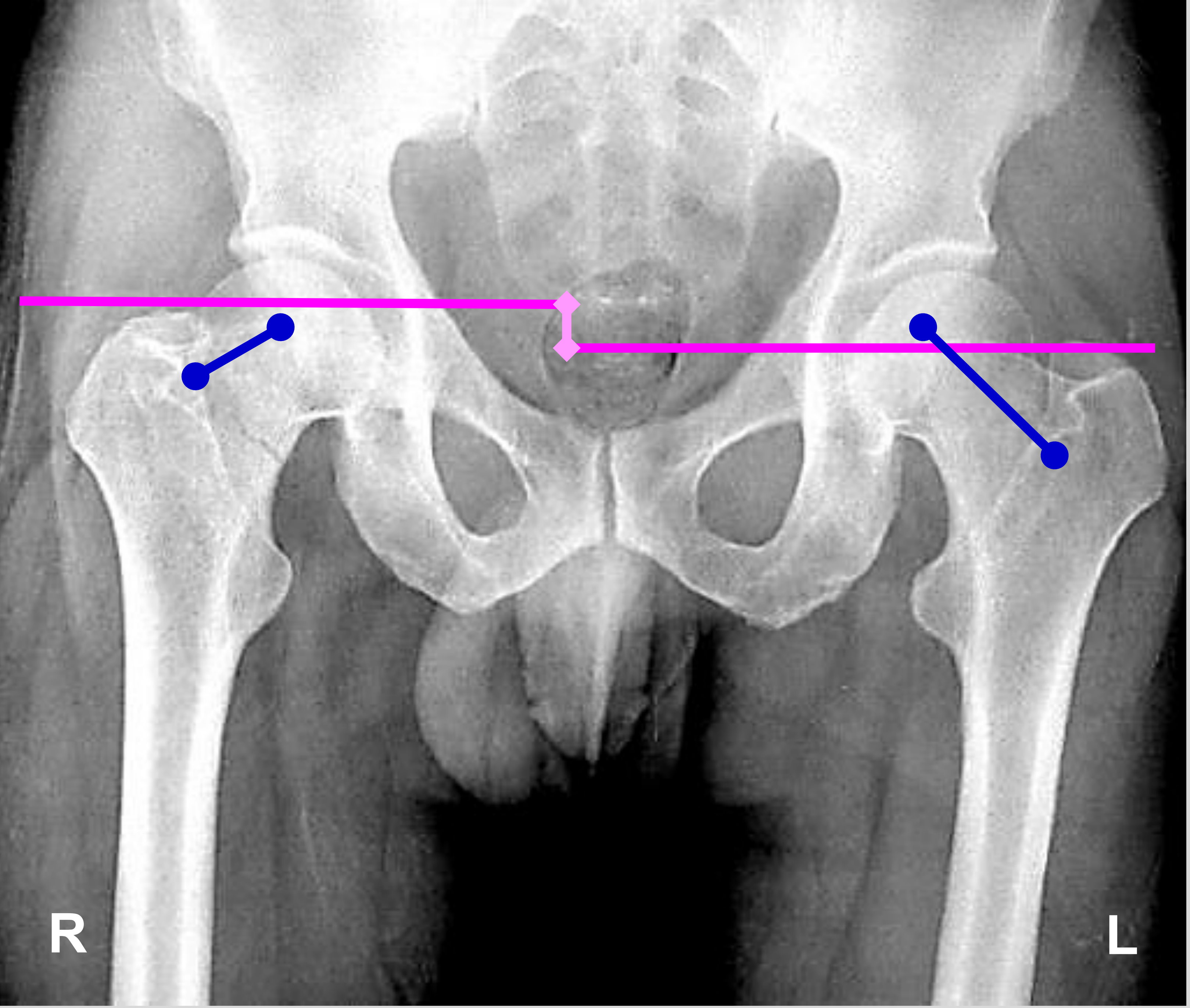
Congenitale heupluxatie links.

(Rechts steil acetabulum, verminderde dekking kop door acetabulum).

Origo-insertieafstand abductoren links kleiner dan rechts.

Spiervezel lengte abductoren links < rechts

http://www.svuhradiolog.ie/case-study/developmental-dysplasia-of-hips/



Inclavatiefractuur rechts.

Trochanter major naar craniaal.

Origo - insertie afstand van de abductoren rechts < links

Vezellengten abductoren rechts < links.

Trochanter major naar mediaal.

Momentsarmen abductoren rechts < links.

https://step1.medbullets.com/msk/107052/femoral-neck-fracture#popup/image/112811

Effect van de momentsarm op de te leveren spierkracht

$Fb = 12\ kgf$

$Fs \times 5 = 12 \times 48$

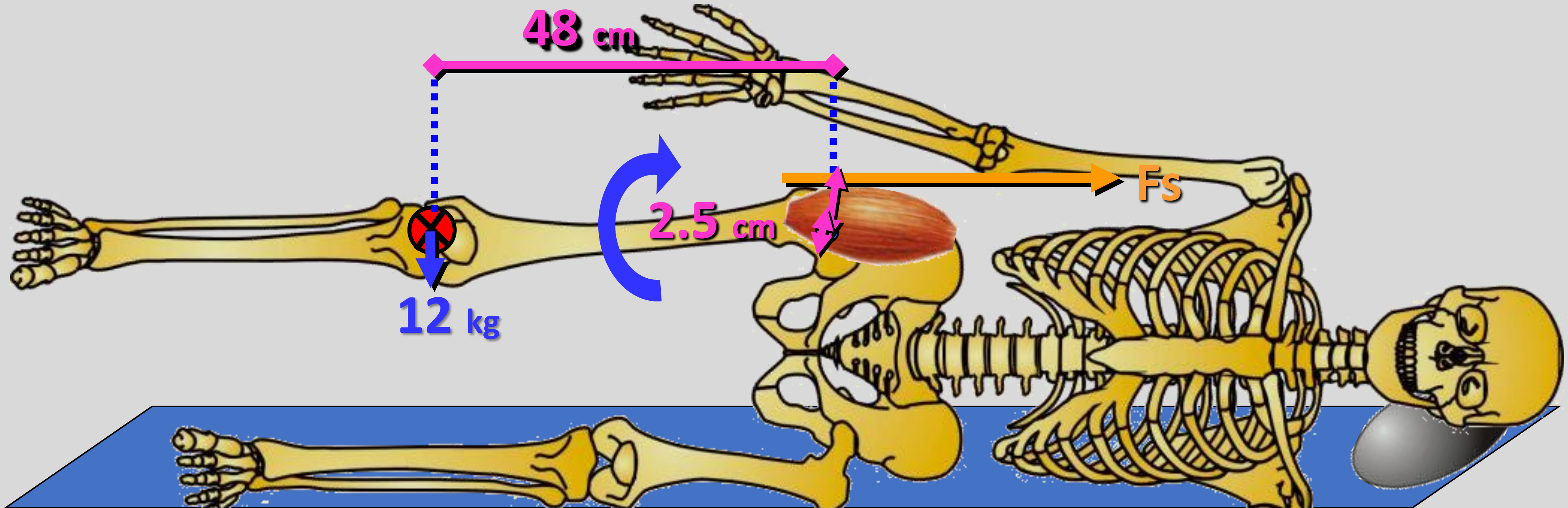
$Fs = \dfrac{12 \times 48}{5} = 115\ kgf$

$Fs \approx 10 \times Fb$

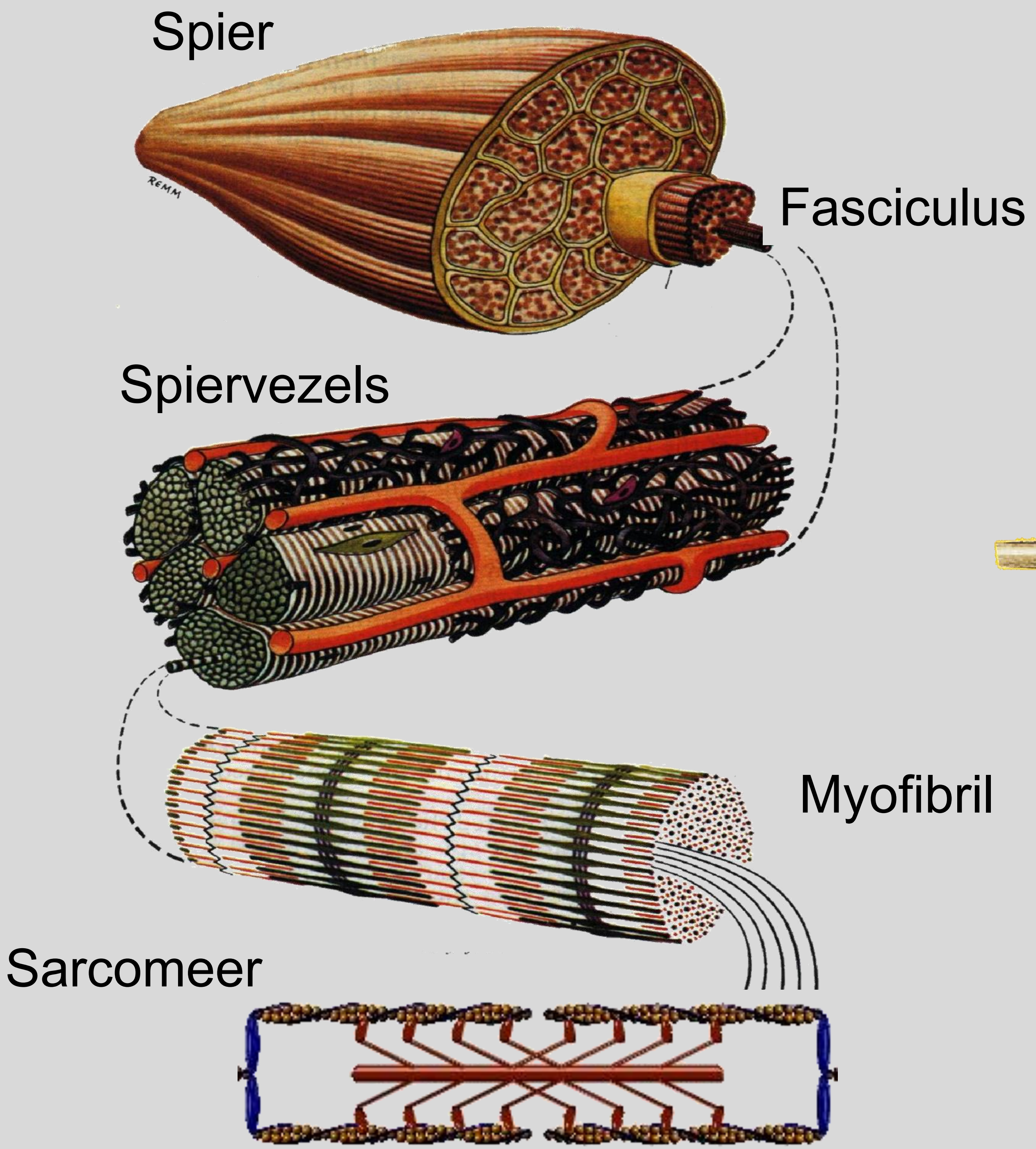
$Fs \times 2.5 = 12 \times 48$

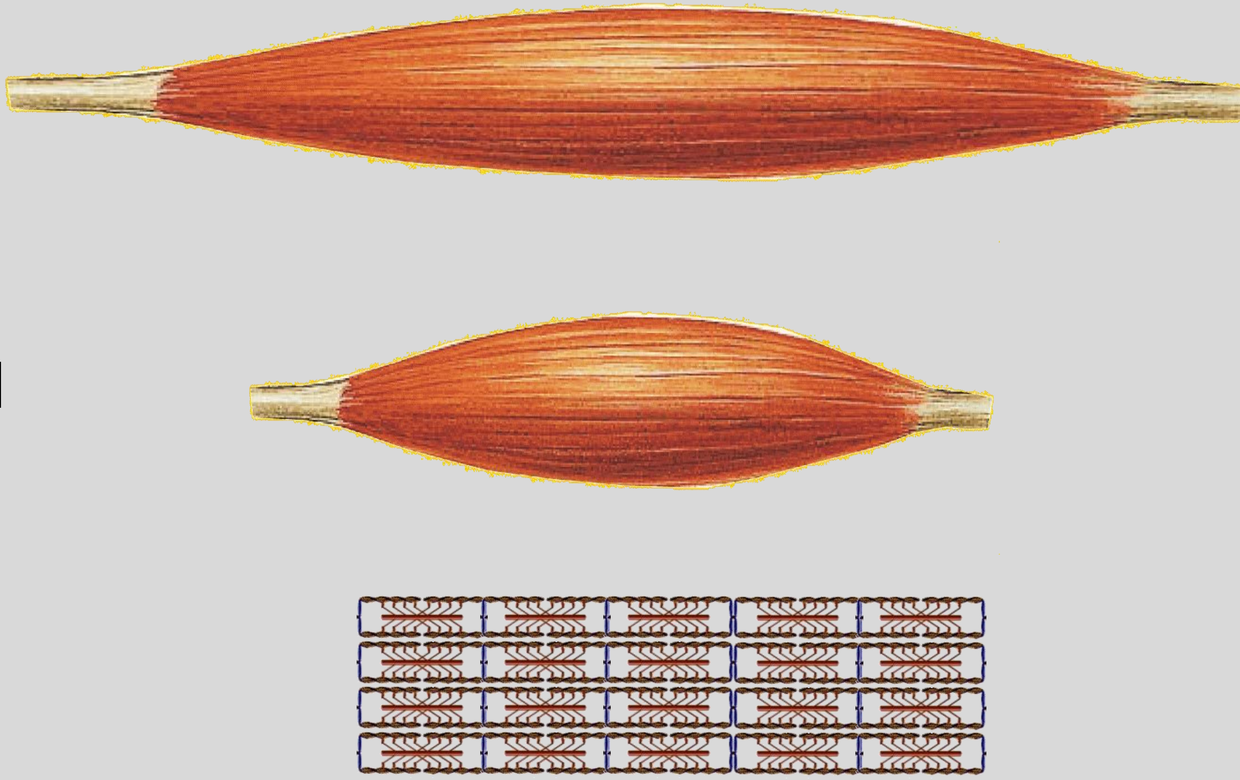
$Fs = \dfrac{12 \times 48}{2.5} = 230\ kgf$

$Fs \approx 20 \times Fb$

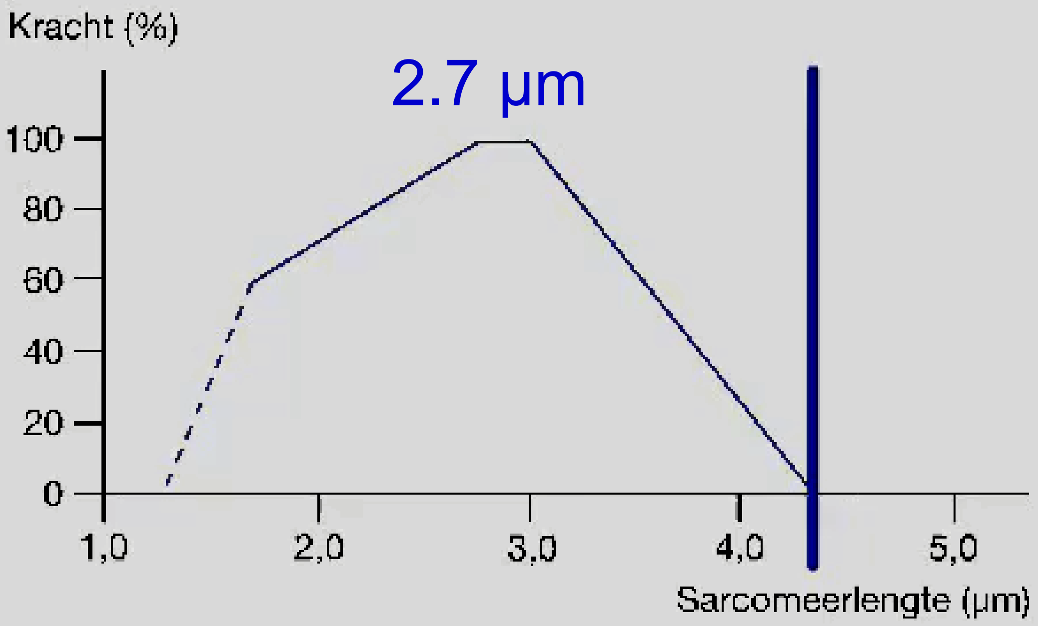


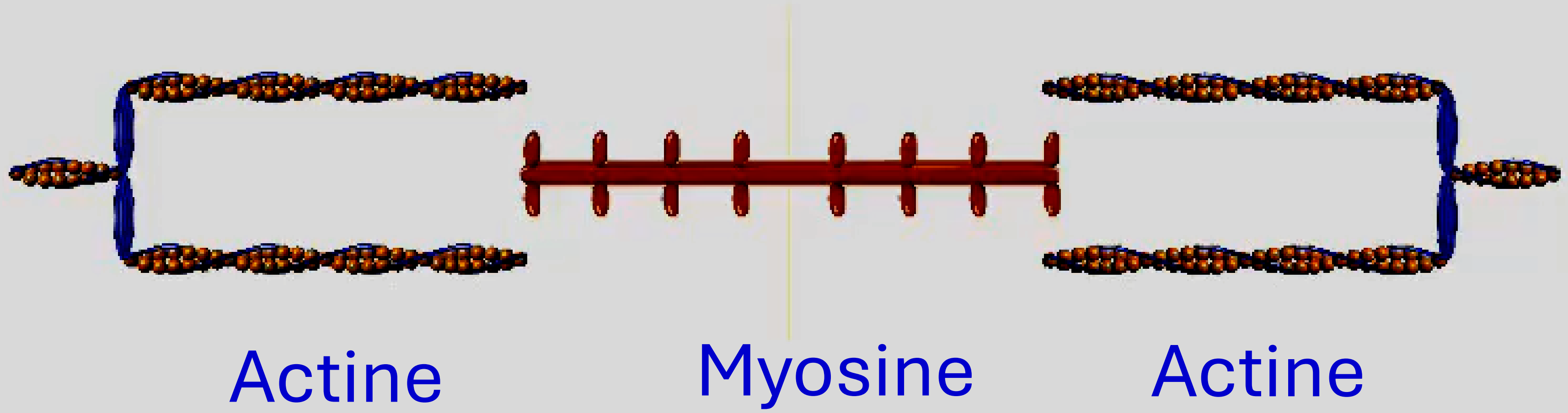
Effect van de vezellengte op de kracht-lengte relatie





Kracht-Lengte relatie





Verkorting en verlenging vanuit de rustlengte:
100 - (Nieuwe Lengte / Oude Lengte) x 100 %

2.7 µm → 1.6 µm

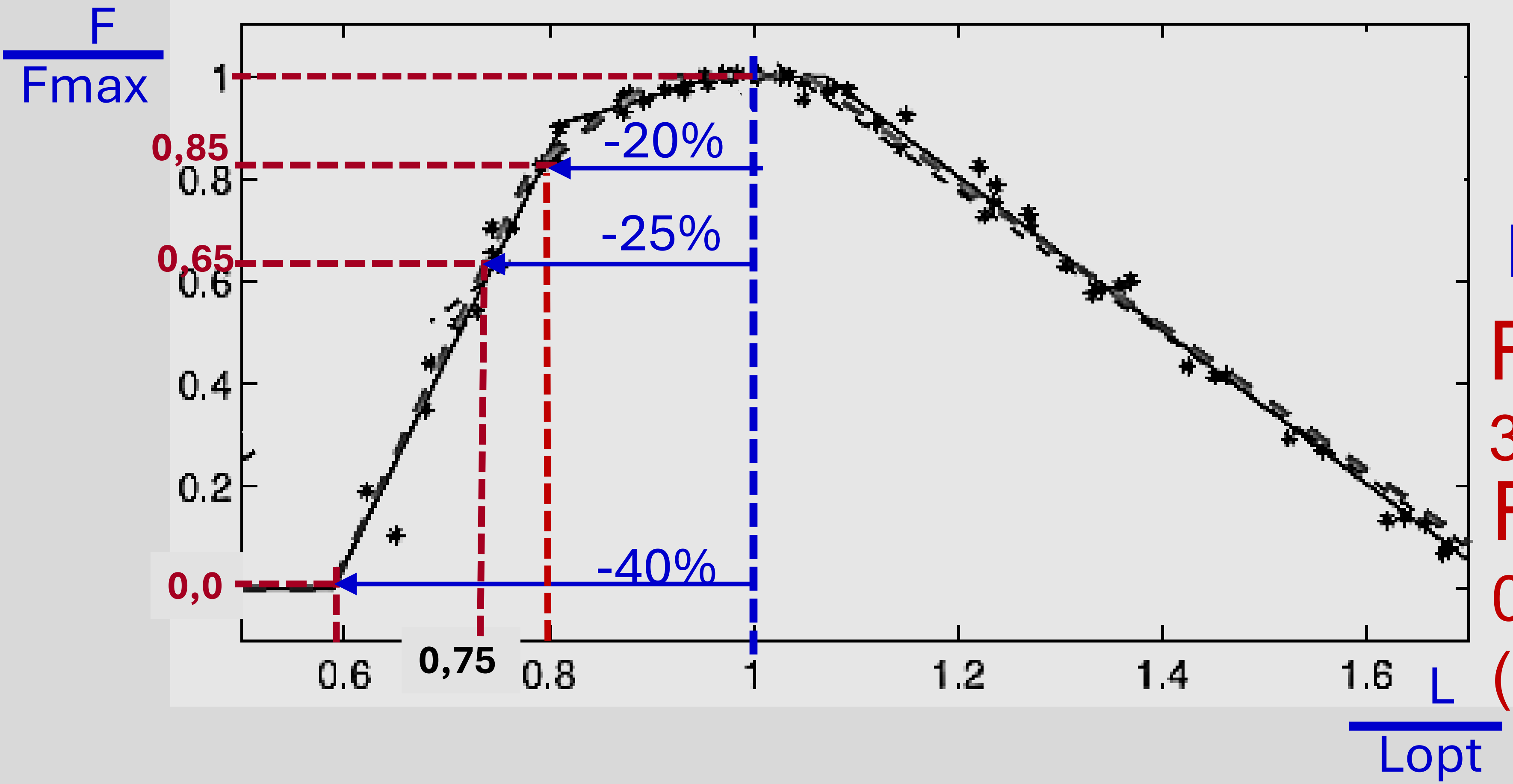
41 %

Max. verkorting

2.7 µm → 4.2 µm

55 %

Max. verlenging



R. Rockenfeller, M. Günther
How to model a muscle's active force–length relation: A comparative study
Comput. Methods Appl. Mech. Engrg. 313 (2017) 321–336

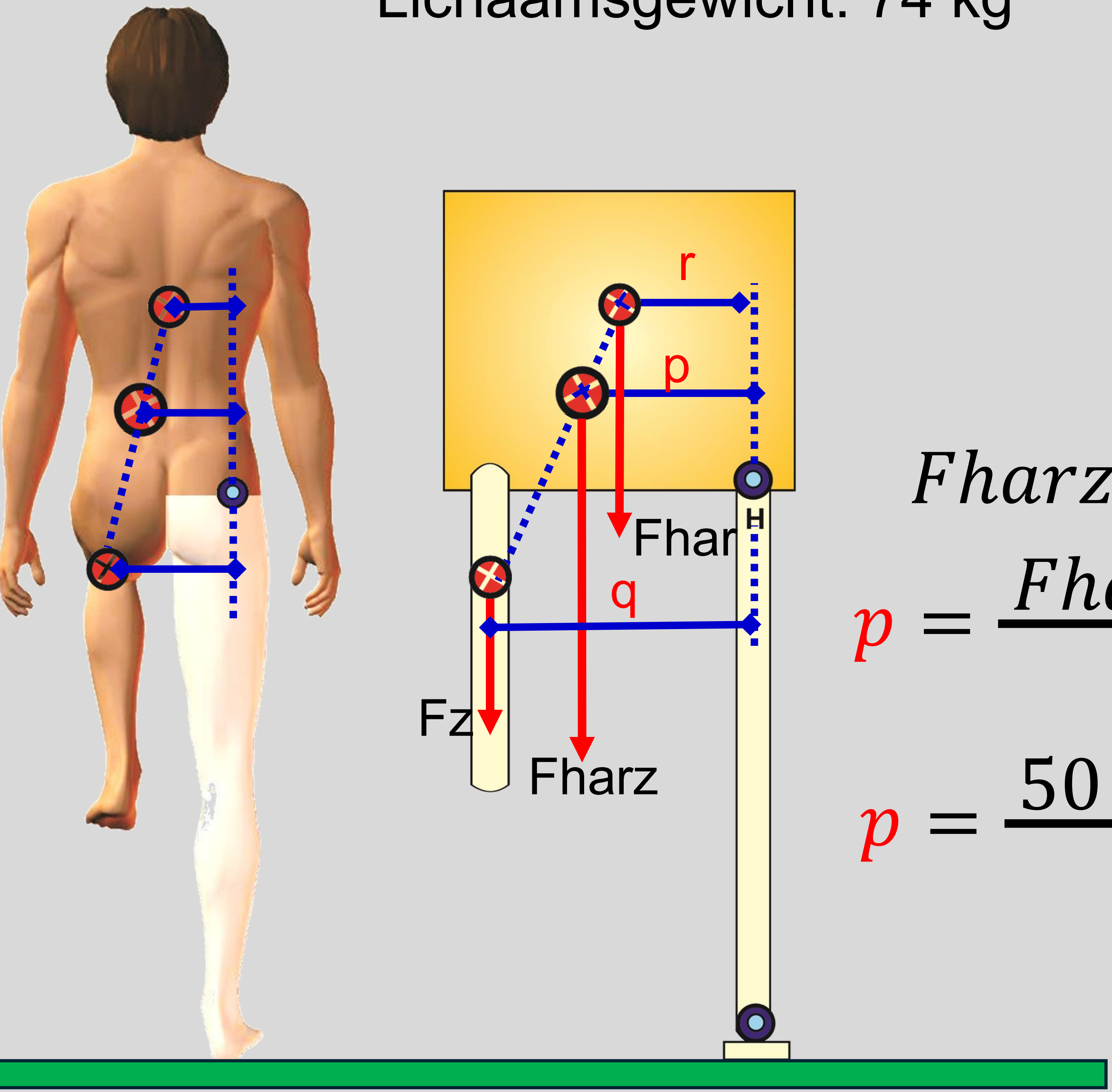
Kracht-Lengte relatie

Fmax zonder verkorting:
3 × 100 = 300%
Fmax na verkorting:
0 + 65 + 85 = 150%
(gehalveerd)

Stel: spierverkorting = 2 cm

Spier	Vezellengte cm	Verkort %	Fmax %
M. glut. med.	5	2/5 x100 = 40	0
M. glut min.	8	2/8 x100 = 25	65
M. tens. Fasc. Lat.	10	2/10 x100 =20	85

Lichaamsgewicht: 74 kg



Fz = 12 kg (16% LG)

Fhar = 74 – (2 × 12) = 50 kg

Fharz = Fhar + Fz = 62 kg

r = 10 cm

q = 20 cm

p = ?? cm

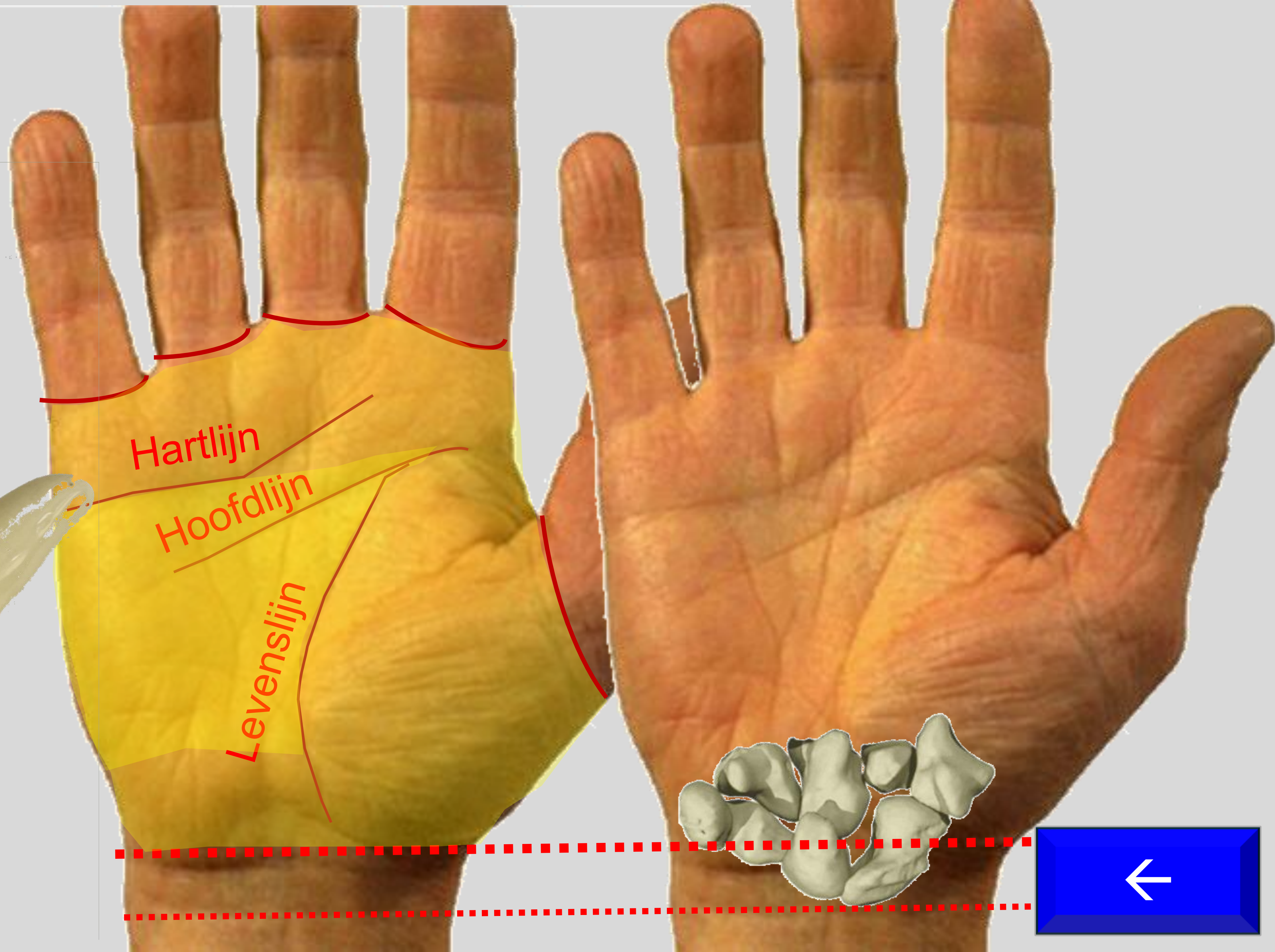
$$Fharz \times p = Fhar \times r + Fz \times q$$

$$p = \frac{Fhar \times r + Fz \times q}{Fharz}$$

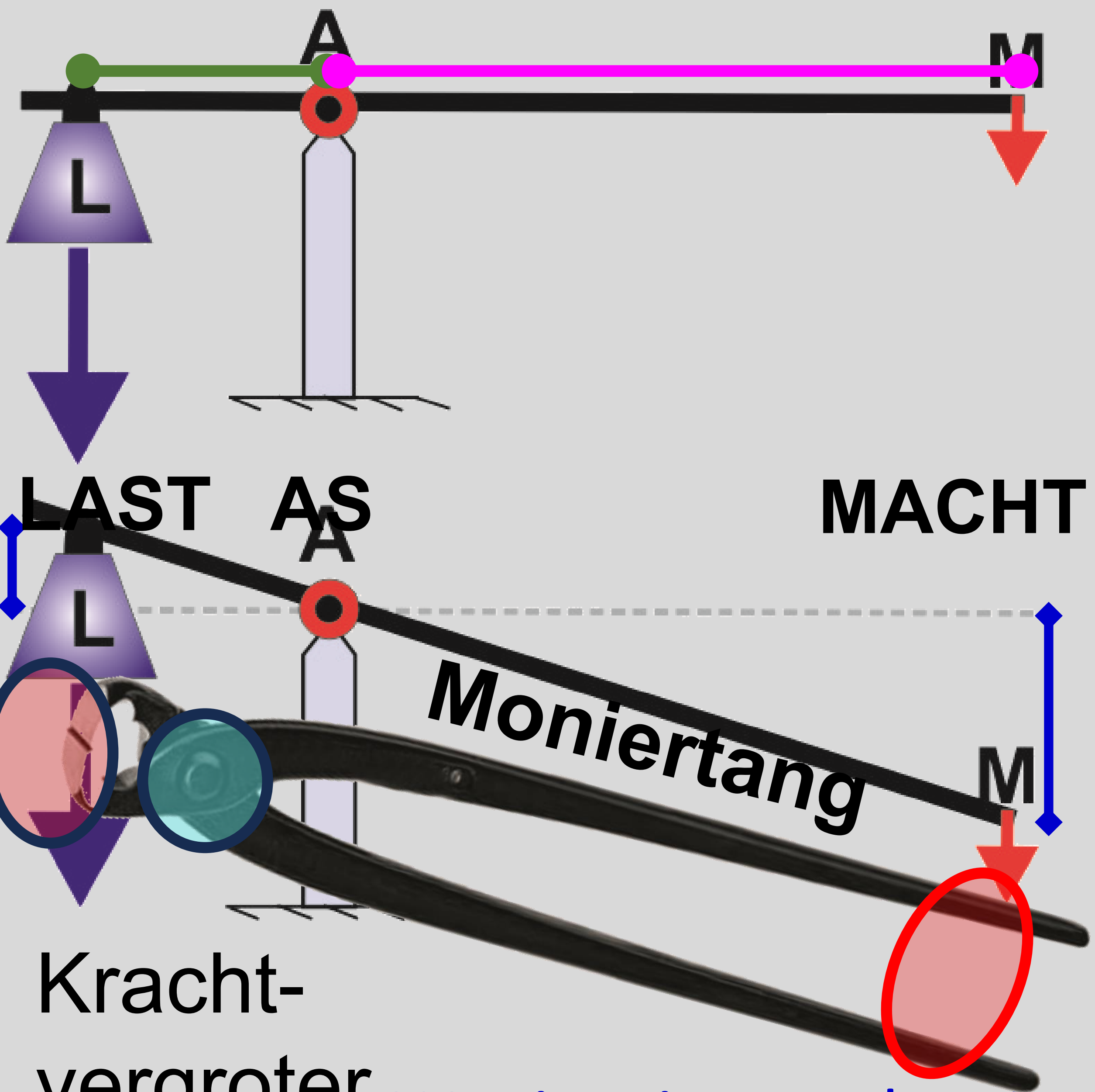
$$p = \frac{50 \times 10 + 12 \times 20}{62} = 12\ cm$$

Chirologie


Marriage Lines
Heart Line
Head Line
Life Line
Line of Mercury
Line of Apollo
Line of Saturn
Travel Lines
The Hand

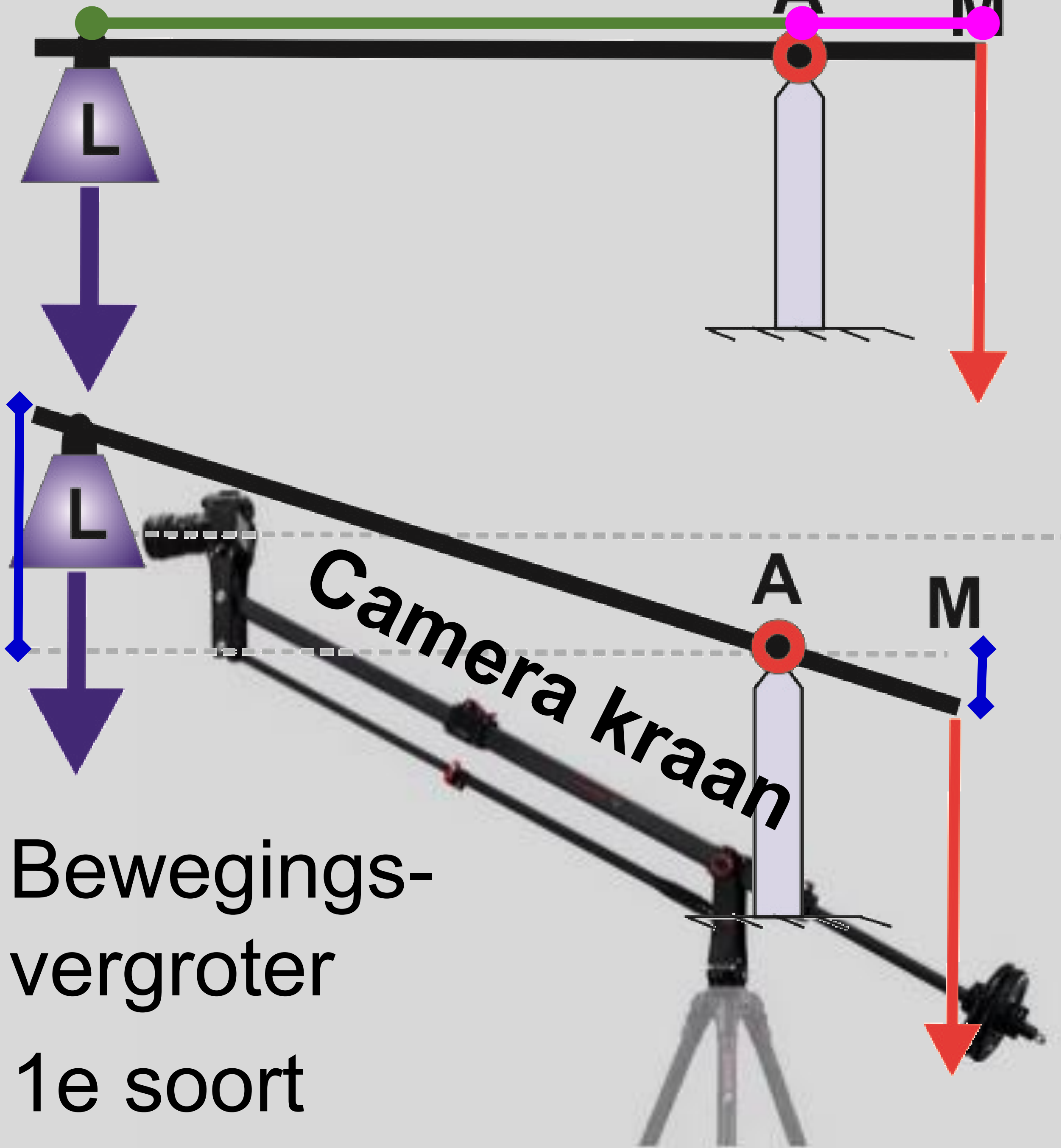

Hartlijn
Hoofdlijn
Levenslijn

HEFBOMEN



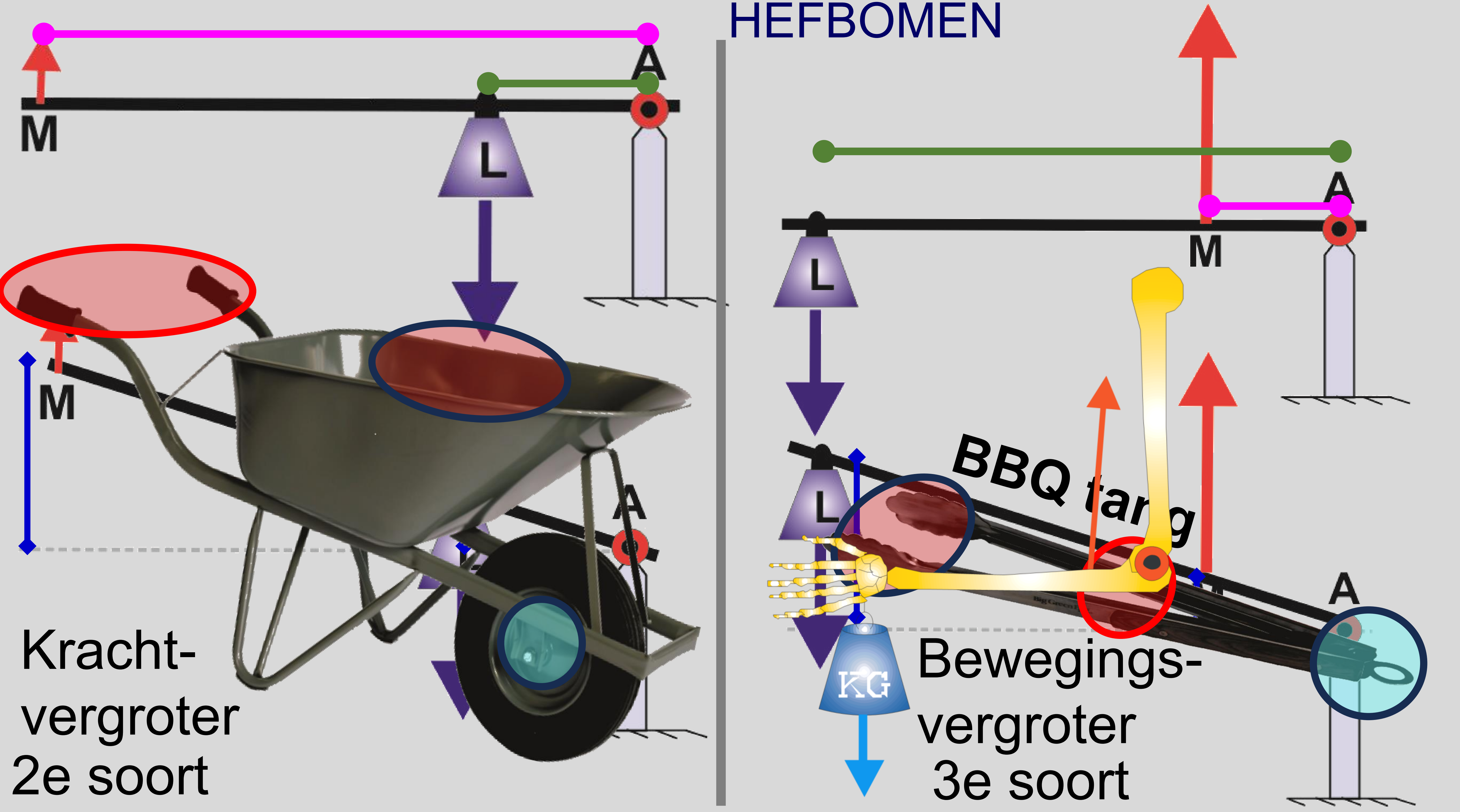
Kracht-
vergroter
1e soort

Wat je wint aan kracht,
verlies je aan weg.

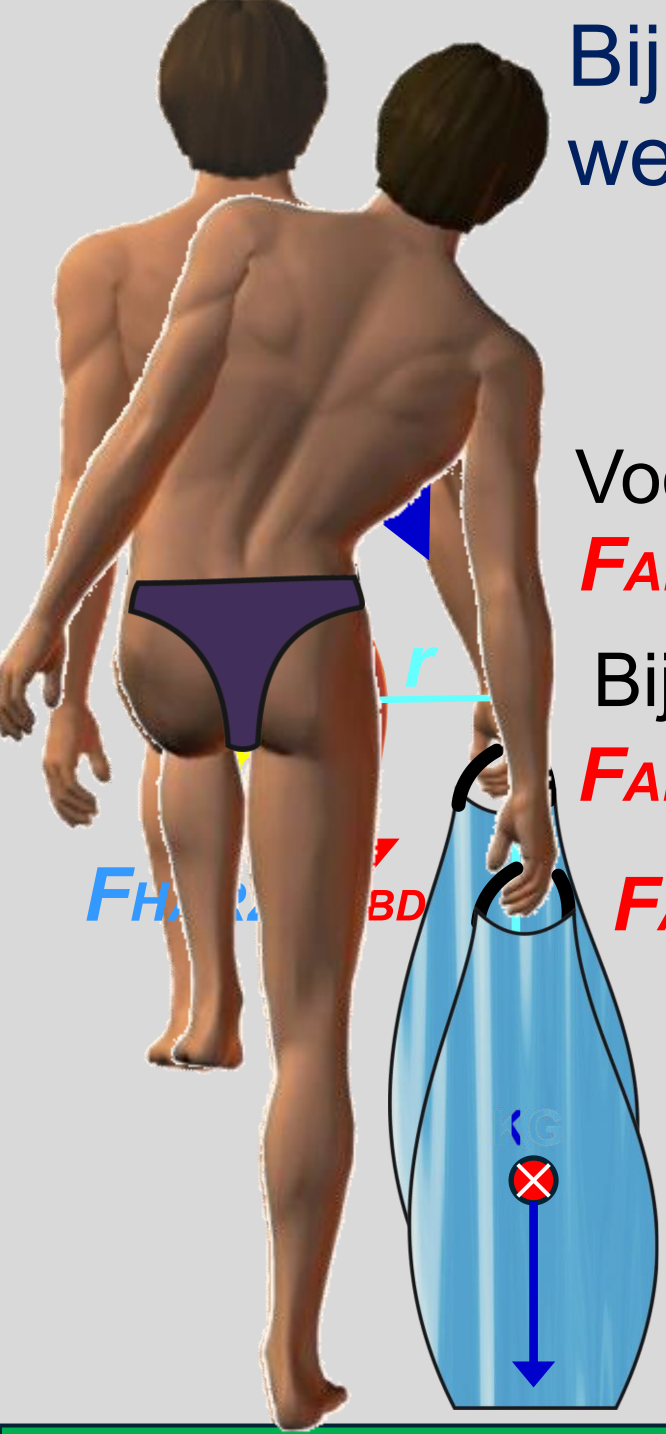


Bewegings-
vergroter
1e soort

HEFBOMEN


M
L
A
M
A
Kracht-
vergroter
2e soort
L
M
A
L
BBQ tang
A
KG
Bewegings-
vergroter
3e soort

Bij Duchenne c,q Trendelenburg : aan welke zijde dragen van een last?
Aan de ***aangedane*** zijde!



Voor evenwicht nodig:

$F_{ABD} \times q = F_{HARZ} \times p$

Bij verzwakte abductoren Re:

$F_{ABD} \times q < F_{HARZ} \times p$

$F_{ABD} \times q + F_{LAST} \times r = F_{HARZ} \times p$

Stel: Beperkte adductie heup en/of valgus enkel