UNIVERSITY HOSPITALS
LEUVEN

Het kwetsbare hoofd van de eenzame fietser

B. Depreitere, MD, PhD
neurochirurg, UZLeuven
professor neurochirurgie, KUleuven

Disclosures

Consultancy opdrachten voor Medtronic en Synthes-Depuy Spine

Johnson&Johnson leerstoel voor onderzoek naar autoregulatie bij hersentrauma

Fietsen in Vlaanderen

Milieu én fietsen én veiligheid én je hersenen

Fietsgebruik in Vlaanderen (Zwerts et al)

- 12% woon-werk verkeer
- 30% van de verplaatsingen in steden
- 53% van de verplaatsingen naar school
- 14,6% van alle verplaatsingen
- 4 miljoen fietsen in gebruik

Evolutie van het aantal doden (30 dagen) in het verkeer, volgens type weggebruiker (2005

	2005	2006	2007	2008	2009	2010	2011			
Personenwagen	624	595	553	479	466	444	458			
Lichte vrachtwagen	44	34	49	40	43	36	29			
Vrachtwagen	16	17	25	25	20	13	15			
Bus	0	0	1	2	0	0	1			
Motorfiets	125	131	139	108	138	102	127	87	102	85
Bromfiets	30	36	26	32	26	22	20	15	13	17
Fiets	71	91	90	86	88	70	70	69	73	76
Voetganger	108	125	104	99	105	106	113	104	99	106
Overige	71	44	84							

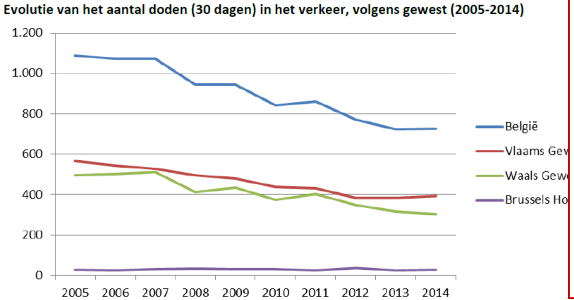
Bron: Algemene Directie Statistiek - Statistics Belgium.

Evolutie van het aantal zwaargewonden in het verkeer, volgens type weggebruiker (2005-2014)

	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Personenwagen	3.530	3.455	3.375	3.381	3.356	2.991	2.768	2.151	2.056	1.743
Lichte vrachtwagen	276	239	244	267	253	199	217	203	166	115
Vrachtwagen	113	97	90	80	66	71	75	68	73	67
Bus	19	22	13	20	7	10	19	7	11	10
Motorfiets	866	842	840	777	888	682	802	635	599	549
Bromfiets	607	580	590	537	436	459	473	451	356	365
Fiets	964	909	936	905	915	867	1.029	1.002	1.044	1.048
Voetganger	729	706	716	702	636	613	686	673	562	527
Overige	171	150	190	114	92	89	99	86	79	78

Bron: Algemene Directie Statistiek - Statistics Belgium.

Evolutie van het aantal doden (30 dagen) in het verkeer, volgens gewest (2005-2014)



Bron: Algemene Directie Statistiek - Statistics Belgium.

Fietsen in Vlaanderen

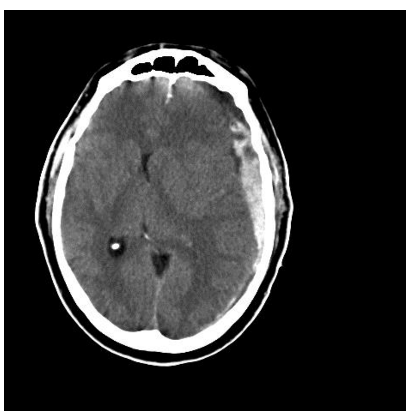
Vlaanderen en attitude

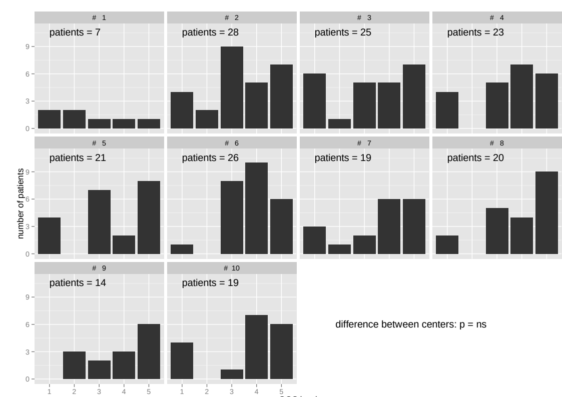
Fietsen en hoofdletsels

- Slachtoffers van fietsongevallen die medische hulp zoeken hebben een <u>schedel/hersenletsel</u> in 21-61% van de gevallen.

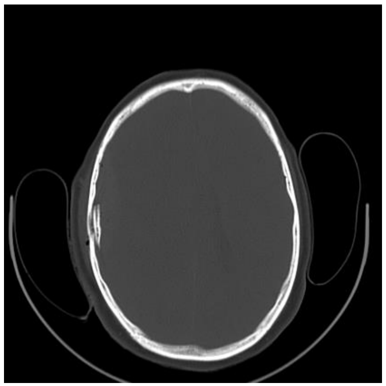
- In dodelijke fietsongevallen is een <u>schedel/hersenletsel</u> de directe doodsoorzaak in 69-93%.

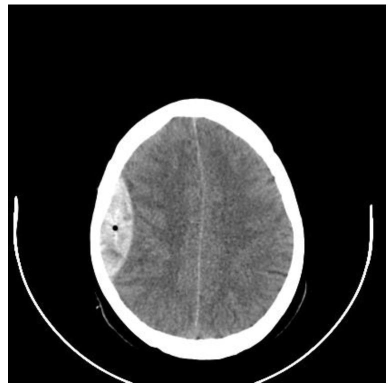
- Kinderen
  - Fietsongeval is de nummer 1 oorzaak van schedel/hersenletsels bij kinderen

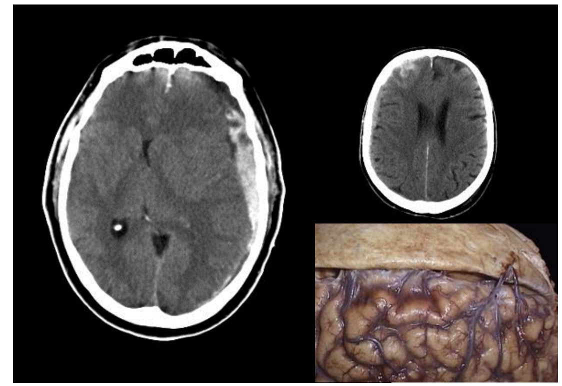


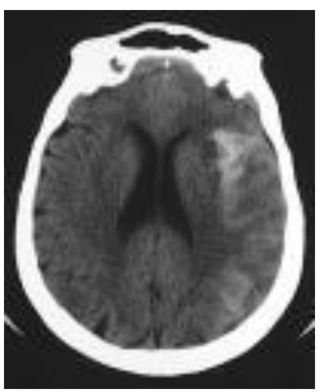


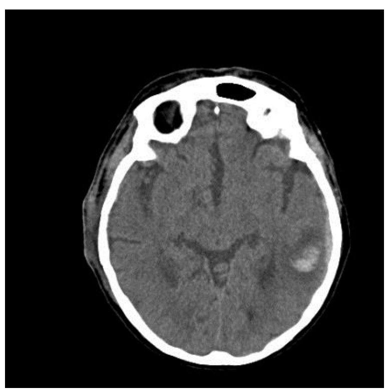
Fietsen en hoofdletsels


Schedelbreuk

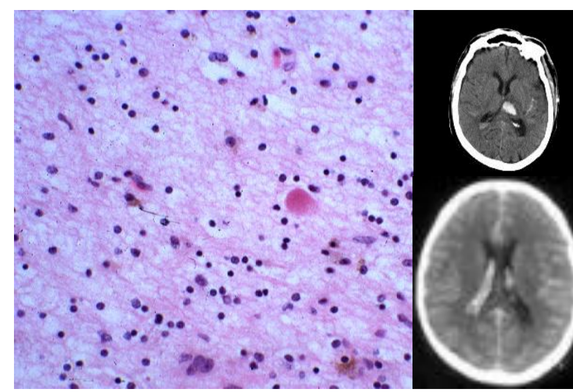

Epiduraal hematoom


Acuut subduraal hematoom


Subarachn. bloed


Kneuzing

Intracerebrale bloeding


Diffuse axonal injury

Fietsen en hoofdletsels

Accident Analysis and Prevention 36 (2004) 561–567

Bicycle-related head injury: a study of 86 cases

Bart Depreitere [a,*], Carl Van Lierde [b], Sigrid Maene [b], Christiaan Plets [a], Jos Vander Sloten [b], Remy Van Audekercke [b], Georges Van der Perre [b], Jan Goffin [a]

Table 1
Frequency of head injuries and *P*-values from *t*-tests for the relation between age and injuries and from Fisher exact (FE)-tests for the relation between gender or accident type and injuries

Injury	Total group ($N = 86$)	No motor vehicle involved ($N = 42$)	Collision with motor vehicle ($N = 44$)	Age (*t*-test)	Gender (FE-test)	Accident type (FE-test)
Skull fracture	74 (86.0%)	39 (92.9%)	35 (79.6%)	0.25	0.38	0.07
Extradural haematoma	34 (39.5%)	17 (40.5%)	17 (38.6%)	**0.0045**[a]	0.78	0.52
Acute subdural haematoma	29 (33.7%)	15 (35.7%)	14 (31.8%)	**0.00037**[b]	0.29	0.44
Contusion	63 (73.2%)	32 (76.2%)	31 (70.5%)	**0.000036**[b]	0.14	0.20
Intracerebral haematoma (arising from contusion)	15 (17.4%)	11 (26.2%)	4 (9.1%)	**0.0036**[b]	0.06	0.035[d]
Basal ganglia intracerebral haematoma	1 (1.2%)	0 (0%)	1 (2.3%)	–	–	–
Gliding contusion	5 (5.8%)	0 (0%)	5 (11.4%)	0.053	0.31	0.031[c]
Diffuse axonal injury	11 (12.8%)	3 (7.1%)	8 (18.2%)	0.25	0.85	0.11[c]
Subarachnoid haemorrhage	45 (52.3%)	21 (50.0%)	24 (54.5%)	0.012[b]	0.44	0.58
Intraventricular haemorrhage	11 (12.8%)	3 (7.1%)	8 (18.2%)	**0.0007**[b]	0.12	0.11[c]
Brain swelling	66/80 (82.5%)	28/38 (73.7%)	38/42 (90.5%)	0.14	0.73	0.046[c]

Fietsen en hoofdletsels

- Belang van hoofdletsels vs. andere letsels in fietsdoden

Journal of Forensic and Legal Medicine 34 (2015) 99–103

Injury patterns and features of cycling fatalities in South Australia

Kelly Olds [a, b], Roger W. Byard [a, b], Neil E.I. Langlois [a, b, *]

Distribution of injuries for traumatic cyclist deaths in South Australia, from 2002 to 2013.

Region	Case 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	Total	%
Head	X	X	X	X	X	X	X	X	X	X	X	X	X		X	X	X	X	X	X	X		X	X	X		X	X	X	26	90
Neck					X						X			X				X	X	X			X	X						8	28
Chest	X	X	X	X	X	X	X	X			X	X	X	X	X		X	X	X	X	X	X	X	X		X		X	X	24	83
Abdo		X		X	X	X	X	X			X	X	X		X		X		X	X		X		X		X		X	X	18	62
Pelvis	X	X	X	X	X	X	X				X		X	X			X		X	X			X	X		X				16	55
Upper limb	X						X				X			X					X				X					X		7	24
Lower limb			X					X			X							X	X											5	17

Fietsen en hoofdletsels

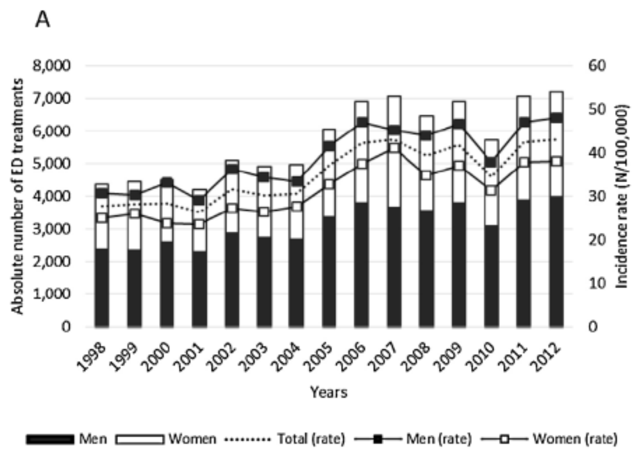
- Belang van ouderen in de statistieken

Accident Analysis and Prevention 81 (2015) 51–60

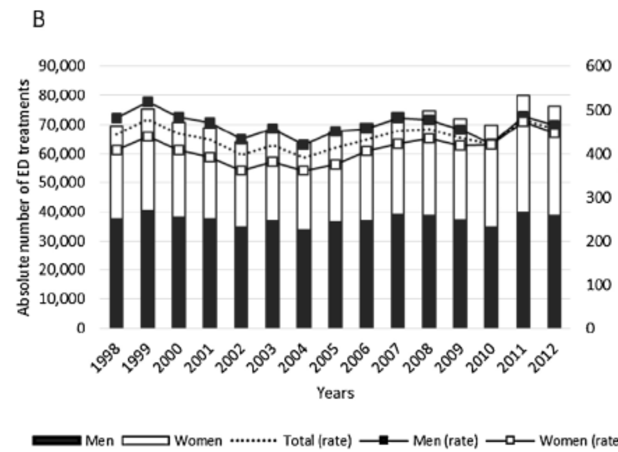
Incidence and costs of bicycle-related traumatic brain injuries in the Netherlands

Annemieke C. Scholten [a,*], Suzanne Polinder [a], Martien J.M. Panneman [b], Ed F. van Beeck [a], Juanita A. Haagsma [a]

Incidenctie fietsgerelateerde hoofdletsels



Incidenctie fietsgerelateerde letsels



Characteristics of bicycle-related TBI (2012).

	0–14 (%)	15–24 (%)	25–54 (%)	55–74 (%)	75+ (%)
N (*N* (%))	1215 (16.9)	1010 (14.0)	2169 (30.2)	2095 (29.1)	701 (9.7)
Incidence rate (per 100,000)	41.9	49.3	31.5	56.6	58.8
Cycle use[a] (billion km)	2.7	2.7	5.5	3.3	0.5
Injury rate[b]	0.45	0.38	0.39	0.63	1.45

Fietsen en hoofdletsels

- E-bikes

E-bikers raken vaker ernstig gewond na fietsongeval

RESULTATEN UIT DE GRONINGSE FIETSONGEVALLENDATABASE

≡ ONDERZOEK ⏲ 18-05-2017

H.P.A.M. (Jeroen) Poos, Tim L. Lefarth, Jorrit S. Harbers, Klaus W. Wendt, Mostafa El Moumni en Inge H.F. Reininga

ntvg Nederlands Tijdschrift voor Geneeskunde

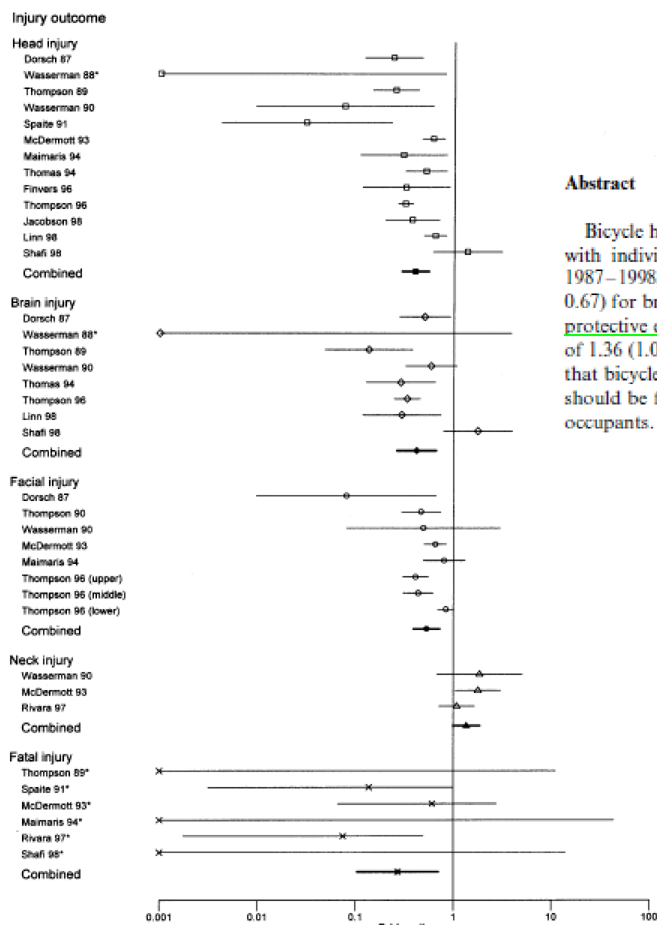
kenmerk	e-bike (n = 92)	klassieke fiets (n = 92)	p-waarde
leeftijd in jaren; gemiddelde (SD)	64,1 (12,1)	63,8 (12,9)	0,90
mannelijk geslacht; n (%)	38 (41)	37 (40)	0,88
comorbiditeit aanwezig; n (%)*	71 (77)	73 (79)	0,72
helm gedragen; n (%)	1 (1)	0 (0)	0,88
eenzijdig ongeval; n (%)	52 (57)	53 (58)	1,00
botsing; n (%)	40 (44)	39 (42)	1,00
ISS; mediaan (uitersten)	6 (0-38)	4 (0-34)	0,07
meervoudig ernstig letsel; n (%)†	20 (22)	10 (11)	0,05
AIS-regio; gemiddelde (SD)			
hoofd	3,1 (1,3)	2,4 (1,3)	0,04
gezicht	1,4 (0,5)	1,3 (0,6)	0,32
nek‡	1,0	1,0	1,00
thorax	2,4 (1,4)	1,8 (1,1)	0,30
abdomen‡	2,0 (0,7)	1,0	0,33
wervelkolom	2,4 (0,5)	3,0 (0,0)	0,27
bovenste extremiteit	1,9 (0,8)	1,7 (0,7)	0,13
onderste extremiteit	1,8 (0,8)	1,7 (0,8)	0,64

Beschermt de helm?

Accident Analysis and Prevention 33 (2001) 345–352

Bicycle helmet efficacy: a meta-analysis

R.G. Attewell [a,*], K. Glase [a], M. McFadden [b]



Abstract

Bicycle helmet efficacy was quantified using a formal meta-analytic approach based on peer-reviewed studies. Only those studies with individual injury and helmet use data were included. Based on studies from several countries published in the period 1987–1998, the summary odds ratio estimate for efficacy is 0.40 (95% confidence interval 0.29, 0.55) for head injury, 0.42 (0.26, 0.67) for brain injury, 0.53 (0.39, 0.73) for facial injury and 0.27 (0.10, 0.71) for fatal injury. This indicates a statistically significant protective effect of helmets. Three studies provided neck injury results that were unfavourable to helmets with a summary estimate of 1.36 (1.00, 1.86), but this result may not be applicable to the lighter helmets currently in use. In conclusion, the evidence is clear that bicycle helmets prevent serious injury and even death. Despite this, the use of helmets is sub-optimal. Helmet use for all riders should be further encouraged to the extent that it is uniformly accepted and analogous to the use of seat belts by motor vehicle occupants.

Beschermt de helm?

Accident Analysis and Prevention 43 (2011) 1245–1251

Publication bias and time-trend bias in meta-analysis of bicycle helmet efficacy: A re-analysis of Attewell, Glase and McFadden, 2001

Rune Elvik*

Table 2
Summary estimates of effects of bicycle helmets. New studies added.

Type of injury	Studies included	Summary odds ratios; fixed-effects model; 95% confidence interval in parentheses ( ); number of estimates in brackets [ ]		Summary odds ratios; random-effects model; 95% confidence interval in parentheses ( ); number of estimates in brackets [ ]	
		Re-analysis, not adjusting for publication bias	Re-analysis, adjusting for publication bias	Re-analysis, not adjusting for publication bias	Re-analysis, adjusting for publication bias
Head injury	As in Attewell et al. (2001)	0.42 (0.37, 0.47) [13]	0.43 (0.38, 0.48) [16]	0.39 (0.28, 0.54) [13]	0.47 (0.34, 0.64) [16]
	New studies	0.71 (0.62, 0.82) [5]	Too few to adjust	0.56 (0.34, 0.90) [5]	Too few to adjust
	All studies	0.51 (0.47, 0.56) [18]	0.57 (0.52, 0.62) [24]	0.43 (0.33, 0.57) [18]	0.58 (0.45, 0.75) [23]
Facial injury	As in Attewell et al. (2001)	0.63 (0.56, 0.71) [8]	0.88 (0.80, 0.98) [13]	0.56 (0.42, 0.74) [8]	0.59 (0.45, 0.78) [9]
	New studies	0.94 (0.81, 1.09) [3]	Too few to adjust	1.17 (0.78, 1.76) [3]	Too few to adjust
	All studies	0.74 (0.67, 0.81) [11]	0.82 (0.75, 0.90) [13]	0.71 (0.57, 0.90) [11]	0.83 (0.67, 1.03) [13]
Neck injury	As in Attewell et al. (2001)	1.36 (1.00, 1.86) [3]	Too few to adjust	1.40 (0.97, 2.02) [3]	Too few to adjust
	New studies	1.24 (0.98, 1.57) [1]	Too few to adjust	1.24 (0.85, 1.82) [1]	Too few to adjust
	All studies	1.28 (1.06, 1.55) [4]	Too few to adjust	1.32 (1.01, 1.72) [4]	Too few to adjust
Head, face or neck injury	As in Attewell et al. (2001)	0.54 (0.50, 0.59) [24]	0.67 (0.62, 0.72) [32]	0.63 (0.52, 0.75) [24]	0.67 (0.56, 0.80) [32]
	New studies	0.87 (0.79, 0.95) [9]	Not adjusted	1.00 (0.78, 1.27) [9]	Not adjusted
	All studies	0.66 (0.62, 0.70) [33]	0.73 (0.68, 0.77) [41]	0.74 (0.64, 0.86) [33]	0.85 (0.74, 0.98) [40]

Beschermt de helm?

Cochrane Library

Cochrane Database of Systematic Reviews

[Intervention Review]

Helmets for preventing head and facial injuries in bicyclists

Diane C Thompson[1], Fred Rivara[2], Robert Thompson[3]

Main results

We found no randomized controlled trials, but five well conducted case-control studies met our inclusion criteria. Helmets provide a 63 to 88% reduction in the risk of head, brain and severe brain injury for all ages of bicyclists. Helmets provide equal levels of protection for crashes involving motor vehicles (69%) and crashes from all other causes (68%). Injuries to the upper and mid facial areas are reduced 65%.

Authors' conclusions

Helmets reduce bicycle-related head and facial injuries for bicyclists of all ages involved in all types of crashes, including those involving motor vehicles. Our response to comments from critics are presented in the Feedback section.

Beschermt de helm?

The American Journal of Surgery (2017) 213, 413-417

Bicycle helmets work when it matters the most

Bellal Joseph, M.D.*, Asad Azim, M.D., Ansab A. Haider, M.D.,
Narong Kulvatunyou, M.D., Terence O'Keeffe, M.D.,
Ahmed Hassan, M.D., Lynn Gries, M.D., Emily Tran, B.S.,
Rifat Latifi, M.D., Peter Rhee, M.D.

Table 3 Adjusted odds ratio for outcomes

Variable	Adjusted odds ratio	95% Confidence interval	*P* value
Severe TBI	.49	.43–.55	**<.001**
Craniotomy	.46	.27–.66	**<.001**
Mortality	.56	.34–.78	**.010**
Any facial fracture	.69	.58–.81	**<.001**
Mandibular fracture	.87	.70–1.05	.833
Malar fracture	.83	.55–1.13	.917
Nasal fracture	.85	.63–1.08	.23
Orbital fracture	.67	.56–.78	**.01**
Contusions/lacerations	.73	.62–.85	**.001**

Each row in the table represents the adjusted odds ratio for helmet use and the stated variable. All logistic regression models were controlled for age, sex, race, insurance status, ISS, GCS, and hypotension; Bold cells indicate statistically significant *P* values.

GCS = Glasgow Coma Scale; ISS = Injury Severity Score; TBI = traumatic brain injury.

Kan de helm beter?

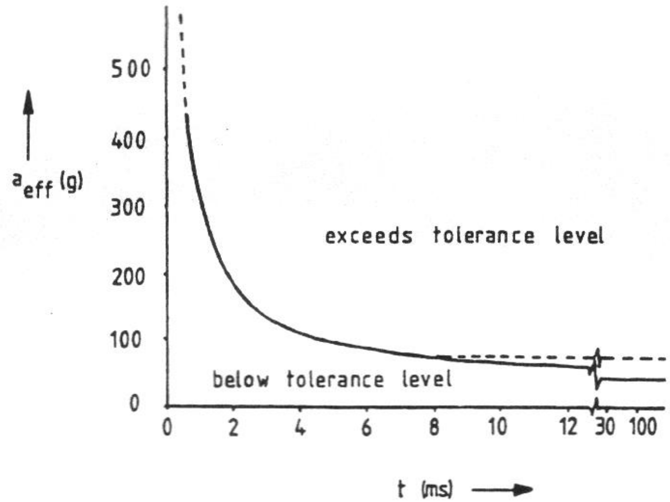
- Inzicht in ontstaansmechanisme verschillende letseltypes
- Mechanische tolerantiecriteria van het menselijk hoofd t.a.v. verschillende letseltypes
- Inzicht in ordegrootte van de mechanische input bij verschillende types fietsongevallen
- Mechanische input onder tolerantiecriterium brengen d.m.v. helm

Kan de helm beter?

Methoden

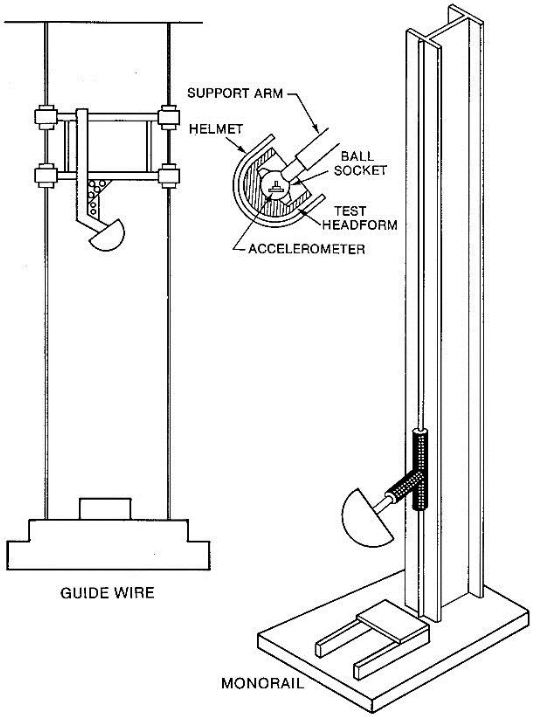
- Reconstructie van real life ongevallen
  - Ordegrootte mechanische input
  - Database: correlaties input-letsels
- Experimenten
  - fysiek, biologisch, dier
- Mathematische modellen
  - Eenvoudige simulaties
  - Finite element modeling
- Materiaalstudies
  - Eenvoudig
  - Complexe vorm

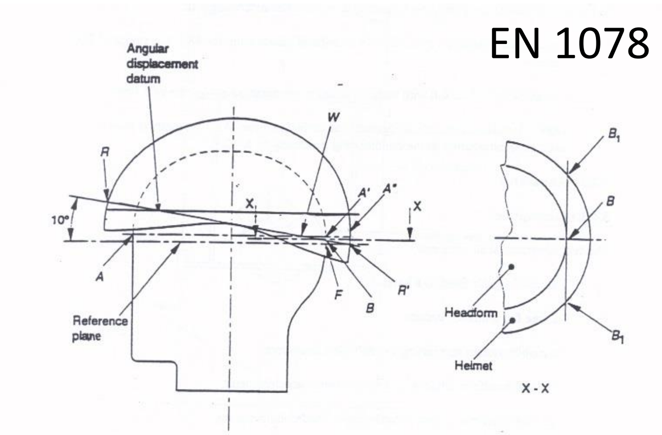
Kan de helm beter?



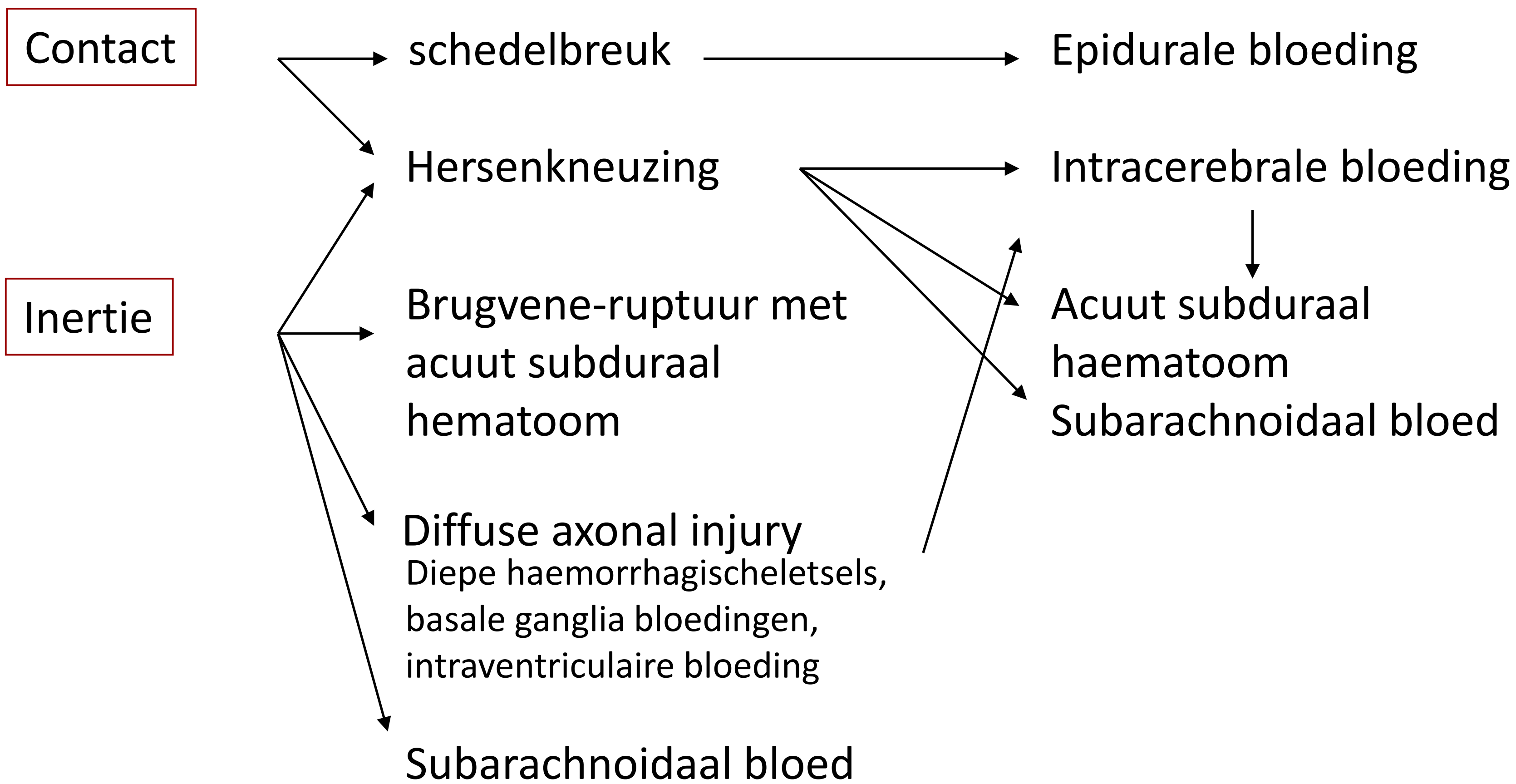
$$HIC = \left[\left(\frac{\int_{t_1}^{t_1+\Delta t} a.dt}{\Delta t} \right)^{2.5} \Delta t \right]_{max} < 1000$$

Kan de helm beter?

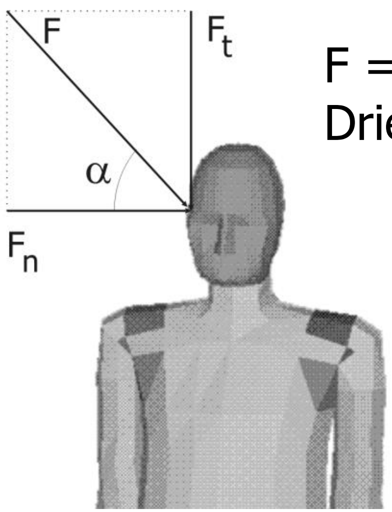




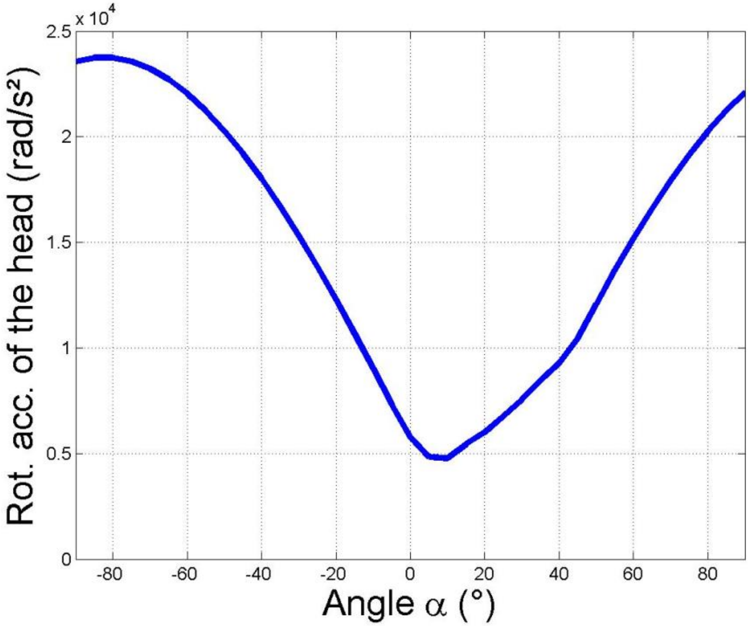
Kan de helm beter?



Kan de helm beter?

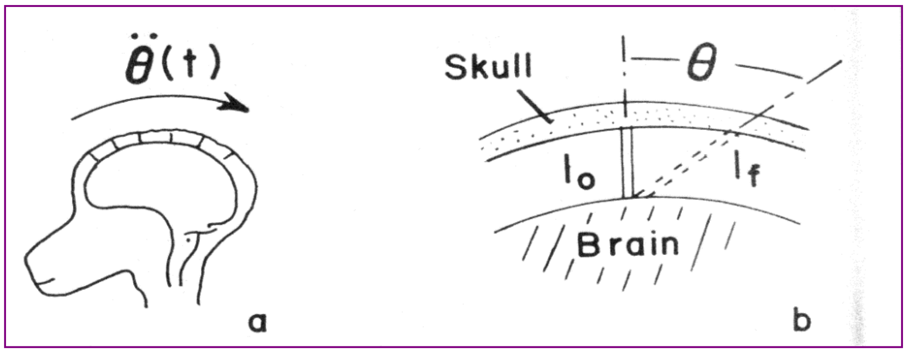


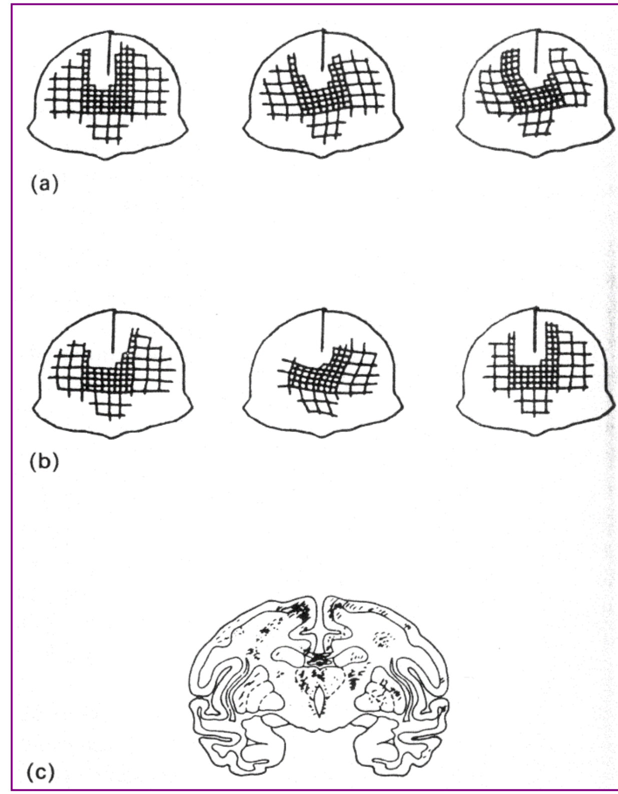
F = 9000N, 1ms
Driehoekige puls



- Rotationele versnellingen treden steeds op, naast de lineaire versnellingen

Kan de helm beter?





Acute subdural haematoma

Diffuse axonal injury

Kan de helm beter?

J Biomech. 1992 Aug;25(8):917-23.

A proposed tolerance criterion for diffuse axonal injury in man.

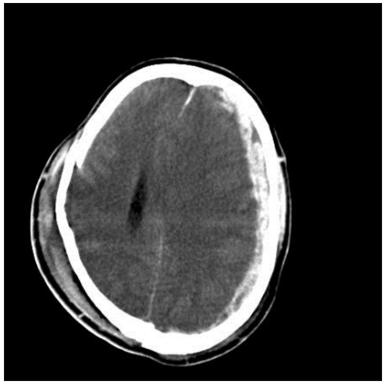
Margulies SS[1], Thibault LE.

Author information

Abstract

The head injury criterion (HIC) is currently the government-accepted head injury indicator. The HIC is not injury-specific, does not relate to injury severity, nor does it take into account variations in the brain mass or load direction. This report focuses on one type of inertial brain injury, diffuse axonal injury (DAI), and utilizes animal studies, physical model experiments, and analytical model simulations to determine the kinematics of DAI in the subhuman primate and to scale these results to man. A human injury tolerance for moderate to severe DAI, which includes the influences of rotational loads and brain mass, is proposed.

Kan de helm beter?

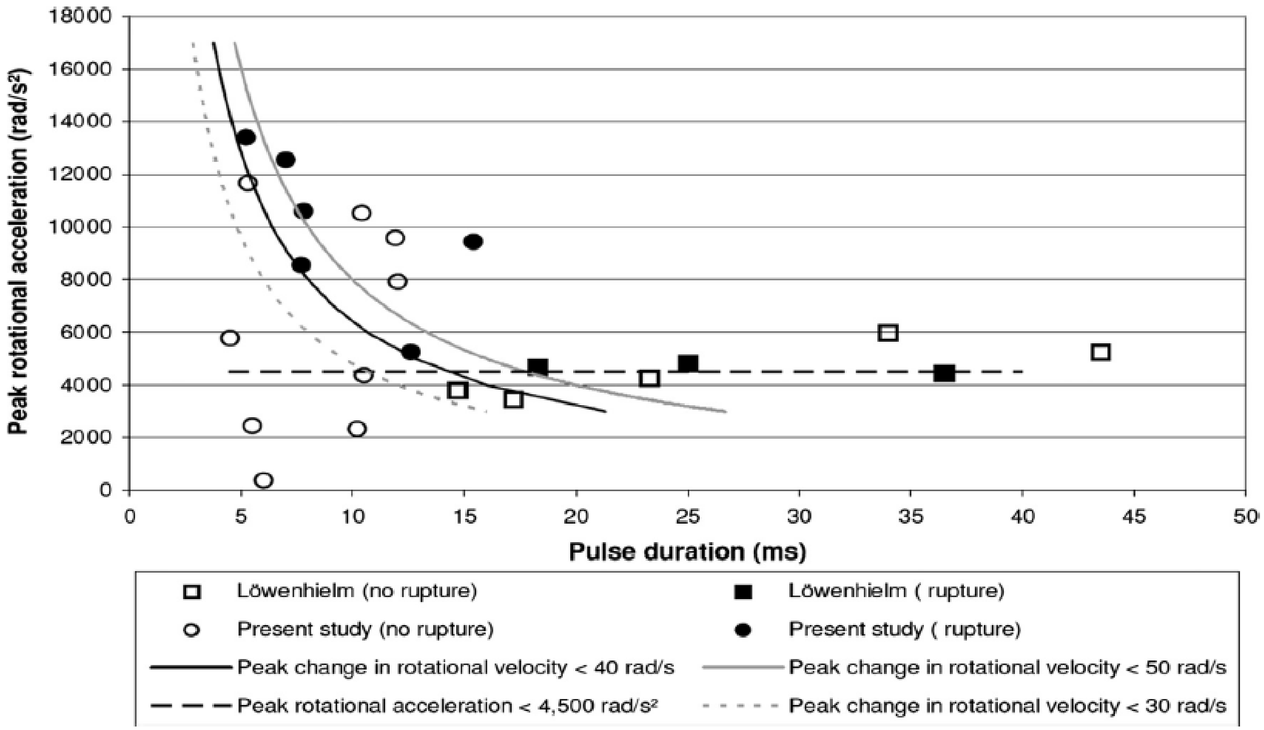


Kan de helm beter?

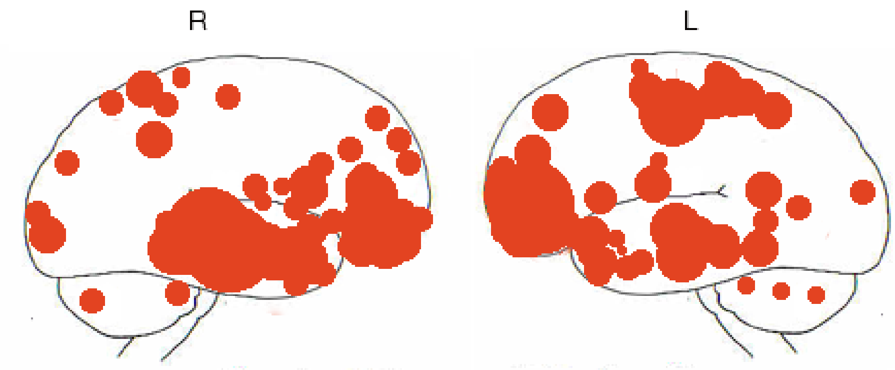
J Neurosurg 104:950–956, 2006

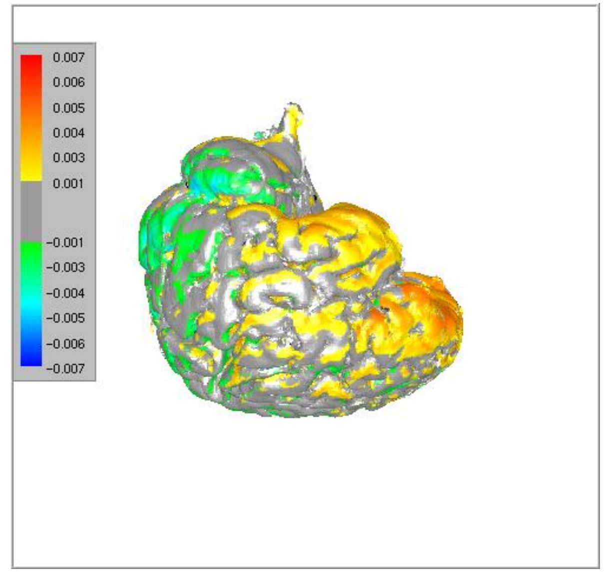
Mechanics of acute subdural hematomas resulting from bridging vein rupture

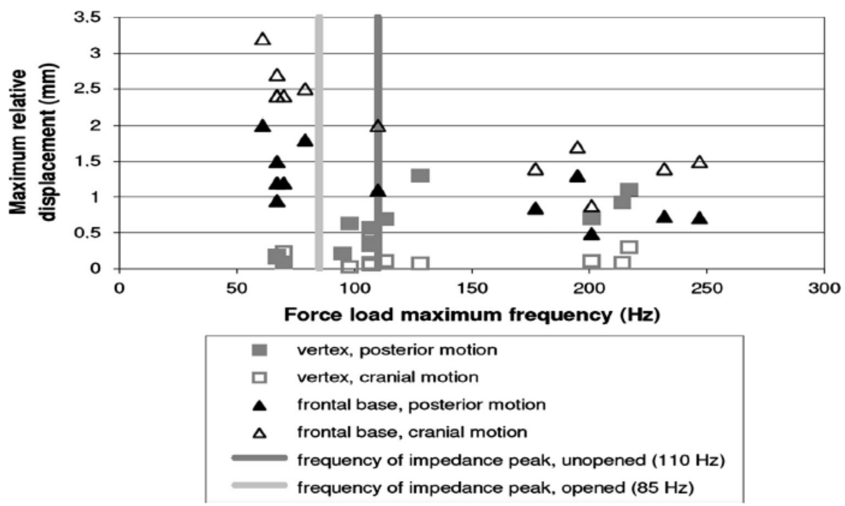
BART DEPREITERE, M.D., PH.D., CARL VAN LIERDE, PH.D., JOS VANDER SLOTEN, PH.D., REMY VAN AUDEKERCKE, M.SC., PH.D., GEORGES VAN DER PERRE, PH.D., CHRISTIAAN PLETS, M.D., PH.D., AND JAN GOFFIN, M.D., PH.D.

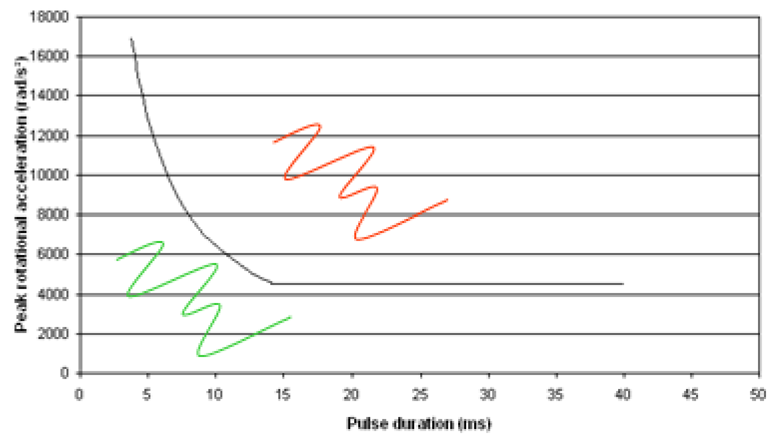


Kan de helm beter?

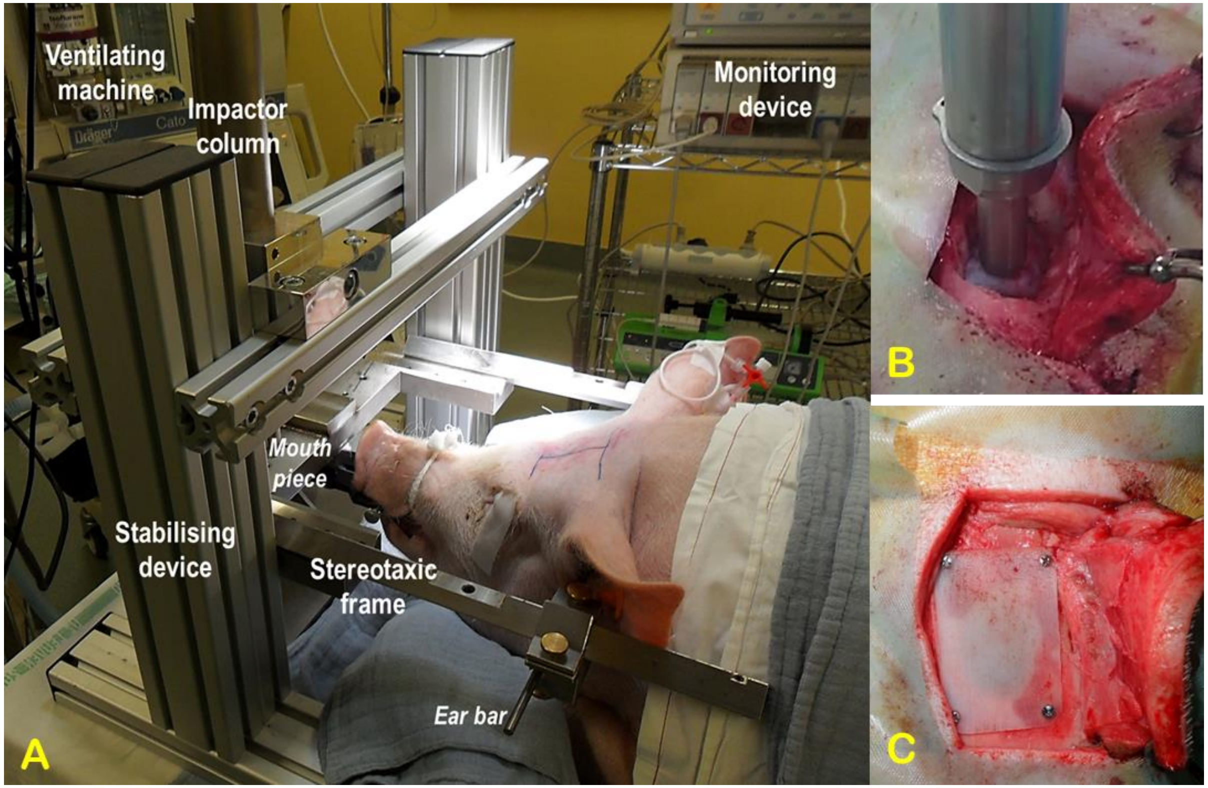


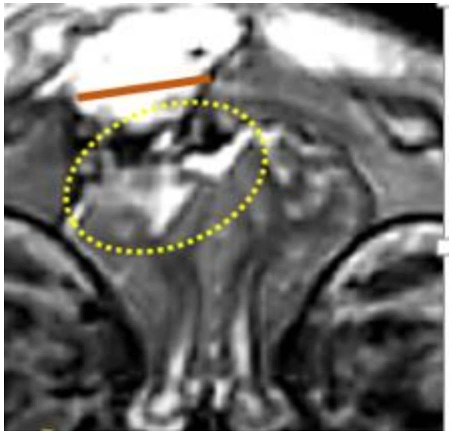


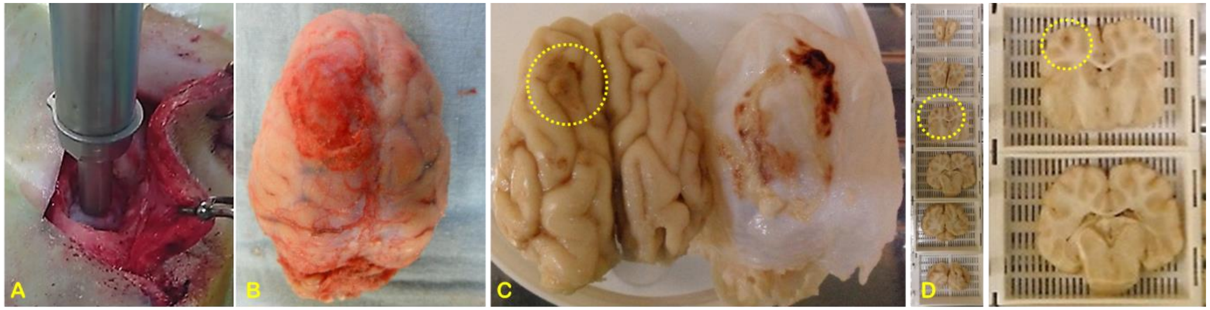




Kan de helm beter?







Kan de helm beter?

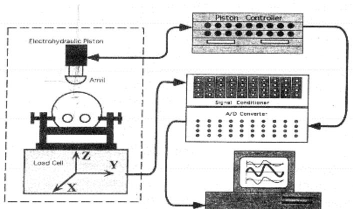
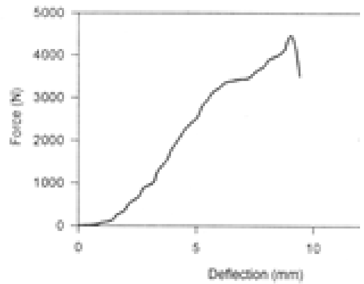
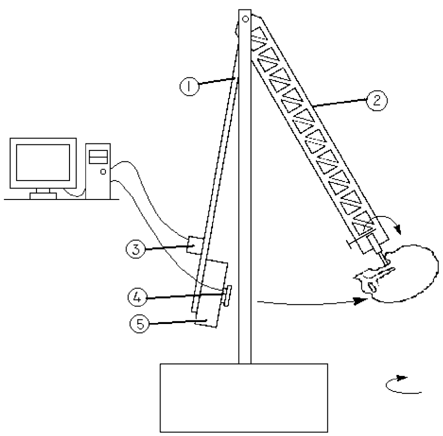
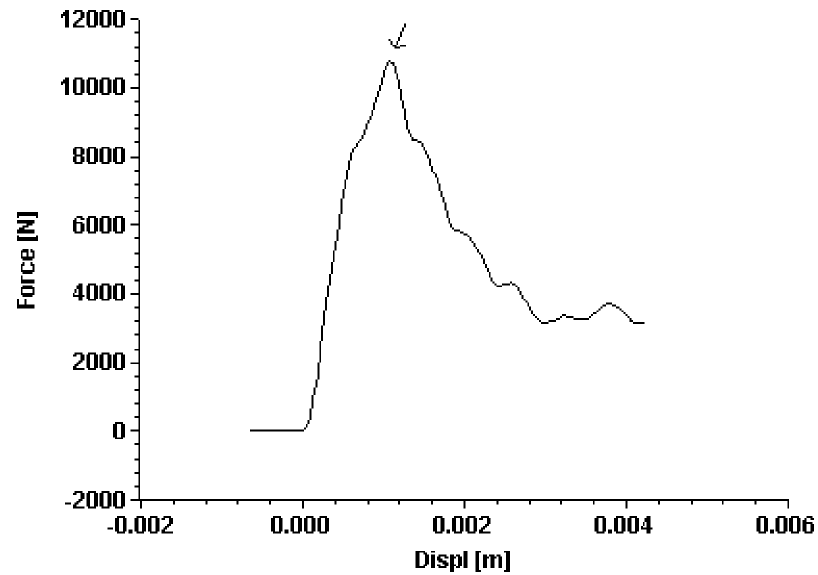


FIG. 1. Experimental setup indicating the custom-designed fixation device capable of orienting the specimen at a desired location, the distal load cell, the electrohydraulic piston for applying controlled quasistatic and dynamic loads, the piston controller housing the function generator for the testing device, the signal conditioning equipment, analog to digital (A/D) converter, and the computer used to acquire biomechanical data. The right-handed Cartesian coordinate system of reference with the z-axis oriented along the vertical direction is also shown. This is in accordance with the ISO coordinate system.







Conclusions

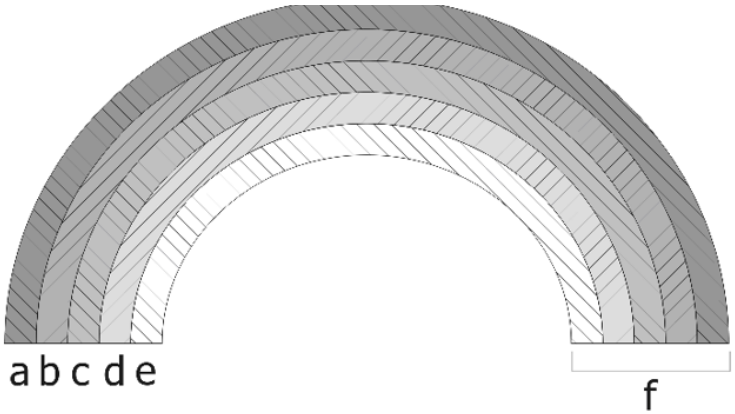
$E_{\#abs}$ depends on impact site (occipital > parietal > frontal < temporal)

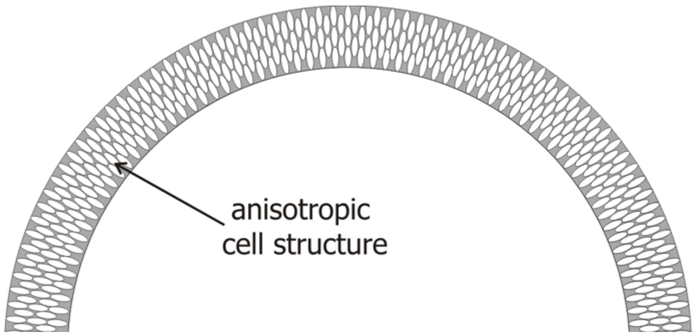
$E_{\#abs}$ depends on impact velocity (kinetic energy input)

Kan de helm beter?

- <u>Letselspecifieke tolerantiecriteria</u>
  - Te verfijnen
  - // hoekversnelling voor ernstigste *hersenletsels*
- Ontwikkeling van nieuwe <u>materialen</u> die
  - Hoekversnelling reduceren
  - Implementeerbaar zijn in fietshelm
  - Op grote schaal produceerbaar

Kan de helm beter?

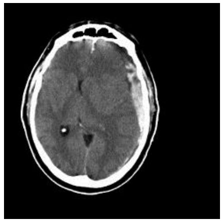




Kan de helm beter?

- Letselspecifieke tolerantiecriteria
  - Te verfijnen
  - // hoekversnelling voor ernstigste *hersenletsels*
- Ontwikkeling van nieuwe materialen die
  - Hoekversnelling reduceren
  - Implementeerbaar zijn in fietshelm
  - Op grote schaal produceerbaar
- Ontwikkeling van te standaardiseren, ondubbelzinnige en reproduceerbare testen voor nieuwe fietshelmnorm

Kan de helm beter?

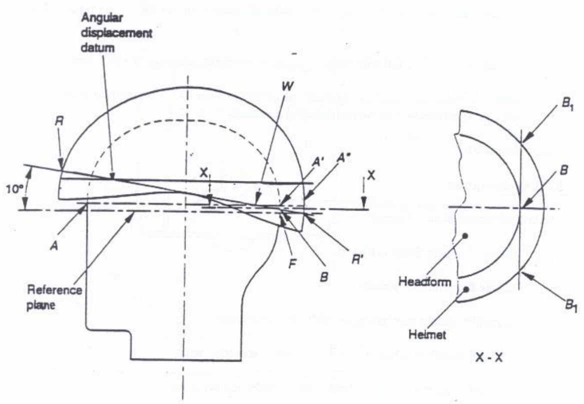


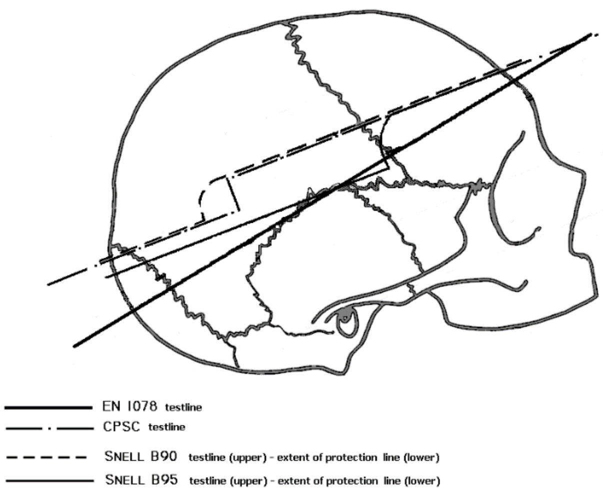
- Man, 71j
- Wielertoerist, helmdrager
- Val door afbreken pedaal
- Linkszijdig impact op het hoofd
- Op spoedgevallen GCS 8, isocoor
- Linkszijdig schouderletsel
- CT-scan: acuut subduraal hematoom
- Onmiddellijke ingreep
- Overleden

- Man, 65j
- Recreatief, helmdrager
- Val, omstandigheden onduidelijk
- Impact rechts vooraan op het hoofd
- Op spoedgevallen GCS 6, isocoor
- CT-scan: acuut subduraal hematoom en kneuzingen
- Onmiddellijke ingreep
- Overleden

Kan de helm beter?

EN 1078



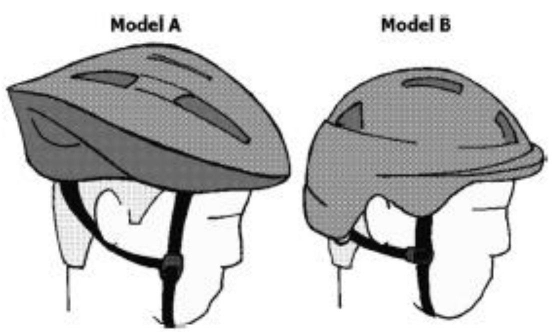


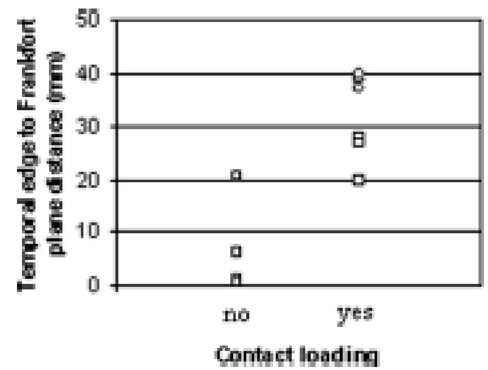
Kan de helm beter?

The Journal of TRAUMA®

Lateral Head Impacts and Protection of the Temporal Area by Bicycle Safety Helmets

Bart Depreitere, MD, PhD, Carl Van Lierde, MSc, PhD, Jos Vander Sloten, MSc, PhD, Georges Van der Perre, MSc, PhD, Remy Van Audekercke, MSc, PhD, Christiaan Plets, MD, PhD, and Jan Goffin, MD, PhD





Kan de helm beter?

Wishlist

- Reductie hoekversnelling
  - Anisotrope schuimlaag
  - Glad oppervlak
  - Met minimaal aantal strategisch geplaatste ventilatie-openingen
- Voldoende bedekking slaapstreek

Prototype

Helmdracht en helmplicht

a. Helm, bescherming en veiligheid

b. Effect van helmplicht op fietsgebruik

c. Individu en maatschappij, noodzaak maatregelen en draagvlak

Helmplicht en fietsgebruik

Risk Analysis, Vol. 32, No. 5, 2012 DOI: 10.1111/j.1539-6924.2011.01785.x

The Health Impact of Mandatory Bicycle Helmet Laws

Piet de Jong*

Risk Analysis, Vol. 32, No. 5, 2012 DOI: 10.1111/j.1539-6924.2012.01770.x

Commentary

Examining the Health-Risk Tradeoffs of Mandatory Bicycle Helmet Laws

Stephen C. Newbold*

Helmplicht en fietsgebruik

Injury Prevention 2007;**13**:190

COCHRANE CORNER

Systematic reviews of bicycle helmet research

None of the studies included in the review measured pre- and post-legislation cycling participation rates, and so it was not possible to comment on the potential adverse effect of helmet legislation. The review authors concluded that based on the best available evidence, there appeared to be a protective effect of bicycle helmet legislation against head injury among cyclists, but that that there was an important need for future evaluative research to include appropriately concurrent control groups, to measure actual helmet use, and to record cycling participation rates.

Rebecca Ivers,
External Editor, Cochrane Injuries Group; rivers@george.org.au

Helmplicht en fietsgebruik

Public Health Ontario | Santé publique Ontario
PARTNERS FOR HEALTH | PARTENAIRES POUR LA SANTÉ

Impacts of Mandatory Bicycle Helmet Legislation

Knowledge Synthesis
August 2015

Results

Findings from the 57 articles included in this review suggest that mandatory bicycle helmet legislation was associated with increases in helmet use and helmet ownership, and decreases in hospitalizations, head injuries, severe injuries, injury severity and cycling related deaths, with mixed results regarding cycling participation and non-head injuries. Decreases among child and adolescent ridership were more commonly seen in jurisdictions with all-age rather than child-only helmet legislation, possibly mediated through reductions in adult role modeling; however role modelling was not measured.

Helmplicht en fietsgebruik

Mandatory helmet legislation and children's exposure to cycling

A K Macpherson, P C Parkin, T M To

Conclusion—Contrary to the findings in Australia, the introduction of helmet legislation did not have a significant negative impact on child cycling in this community.

(*Injury Prevention* 2001;7:228–230)

Helmplicht en fietsgebruik

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a. Helm, bescherming en veiligheid

b. Effect van helmplicht op fietsgebruik

c. Individu en maatschappij, noodzaak maatregelen en draagvlak

Dank u

Medewerkers

Jos Vander Sloten
Jan Ivens
Nele Famaey
Ignaas Verpoest
Jan Goffin
Carl Vanlierde
Peter Verschueren
Hans Delye
Esmeralda
Aida Monea
Katrien Baeck
Zhaoyin Cui
Grace Musigazi
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bart.depreitere@uzleuven.be