The vertebral spine as the human axis organ, physiological background and pathophysiological disturbances

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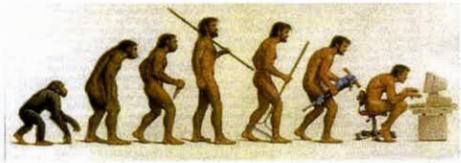
Introduction



Evolution from „Homo erectus" to „Homo sedens"

Die Aufrichtung und Entwicklung des Menschen vom "Homo erectus" zum "Homo sedens".

Vertebral column
term of the description period of anatomy

Human axis organ
central organ of the human body

Human axis organ I
Functions

- Carrying the human head with brain and all important sensory organs
- Carrying the human body
- Responsible for movements of the head in all dimensions
- Fixation of shoulder girdle and the upper extremities
- Fixation of pelvis with the lower limbs
- Fixation of inner organs:
  - chest with cardio-respiratory organs
  - abdominal organs

Human axis organ II
Regulation for posture and turning movements midbrain-pontine centre

- Adaptation of the human body in the gravity field
- Basis for all movements of the human body in the gravity field
- Readaption of the body position by the postural and turning reflexes due to the vestibular apparatus and the receptors of cervical spine, lumbar and thoracic spine

Phylogenetic development of the axis organ, the vertebral column

- Tunicata, external skeleton
- Development of Chorda dorsalis (amphioxus)
- Development of cartilage fish
- Development of the vertebral column
  - Horizontal position of the vertebral column
    - bone fish, amphibias, reptiles
      → arch bridge construction, partial developed
    - terrestic tetrapods (mammalians, aquatile mammalians)
      → arch bridge construction, full developed
  - Vertical position of the vertebral column
    - human being
      → lattice tower construction

Tunicata, insects, echinoderms

- External skeleton
  - Protozoa
  - Annelida
  - Mollusca
  - Insects
  - Echinoderms
- Muscles, tendons, inner organs are inside the skeleton

Tetrapods
arch bridge construction

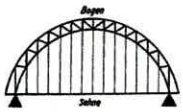


Abb. 6. Schema des Konstruktionsprinzips der Säugerwirbelsäule. Nach Slijper.

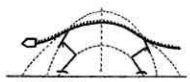


Abb. 4. Schema der Wirbelsäule eines primitiven Säugetieres. Nach Böker.

- Bow consists of two parts: upper belt and lower belt
  - Upper belt: vertebral arch, spine of vertebra, ligamenti, back muscles
  - Lower belt: vertebral body, vertebral disc, ligamenti, short and long tendons, muscles
- bow string: cranial fixed by the rips (chest), caudal fixed by abdominal muscles

Tetrapods
scheme of the arch bridge construction

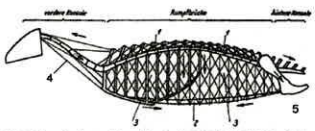


Abb. 7. Schema des Konstruktionsprinzips der Wirbelsäule beim Vierfüßler: 1. Wirbelsäule in Form einer flachen Kyphose; 2. Sehne in Form der langen ventralen Rumpfmuskeln; 3. Querverstrebungen in Form der Rippen und sebrigen Rumpfmuskeln.

- Flat kyphosis of spine (1)
- Bow string long ventral trunk muscles (2)
- Rips (chest) and diagonal trunk muscles (3)
- Anterior console (4)
- Posterior console (5)

Vertebral column in tetrapods

- Thoracic and lumbar spine
  - Fixation of the extremities for standing and locomotion
  - Support in jumping
  - Fixation of rips and the diaphragm for respiration
  - Fixation of inner organs
- Cervical spine
  - Carrying the head with brain, sensory organs including vestibular apparatus
  - Responsible for free movement of the head
  - Receptors for gravity (neck muscles, tendons, cervical joints)
- Tail, used for balance
  - special motion receptors
- Balance, continuous regulated by postural and turning reflexes of the midbrain centres

Tetrapods
Spine maximal integrated in the running movement, galloping dog - high speed possible

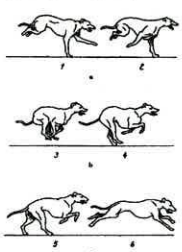


Abb. 8a–c. Bewegungsfolge eines galoppierenden Hundes mit maximaler Beteiligung der Wirbelsäule.

Tetrapods
big herbivores
spine serves fixation of the four extremities for standing and locomotion

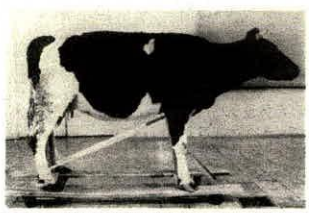


Abb. 9. Ausgestopfte Kuh. Das Präparat zeigt, daß die Bogenbrücke auch nach dem Tode noch tragfähig ist.

'Great' vertebrates
tetrapod and bipeds in normal gravity

Vertebral column changement in special biotops
passager lordosis in the lumbar region

Lithocranium Walleri

a) Arch bridge construction

b) Lordosis during feeding

Vertebral column in special situations
kangaroo in defence state, lumbar lordosis

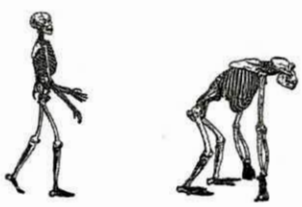
Abb. 10. Känguruh mit Lordosenbildung. Nach Bökk.

Lift-grasp-climbing position
neck and lumbar lordosis
development of dome construction of vertebral spine

Arch bridge construction
changing to lattice tower construction

Abb. 12. Lordose (schematisch) beim Aufrichten im Zuge des Stemm-Greif-Kletterns.

Lattice tower position

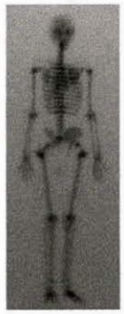


a) Human: lattice tower position

b) Gorilla: lattice tower position, rest of vault bridge construction

a) b)

Homo erectus, lattice tower position dome function of the vertebrates



Cervical lordosis
thoracic kyphosis
thoracic-lumbar lordosis
fixed kyphosis of sacrum

"The design" of the human vertebral column is uncompleted, Koch 1964

Special function of cervical spine turning movements in 3 dim.

Development of the Atlas-Axis-system

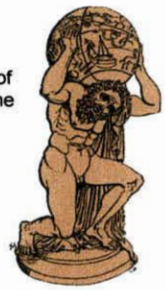
Three steps:

1. development of 2 condyls on os occipitale (amphibias),
2. development of a second level, the atlas-axis-joint, rebuilding of dens by loss of the first disc (tetrapods),
3. special axis-dens-system, great autonomy, but highly vulnerable (man)

Atlas, the titan giant

„Who is carrying"

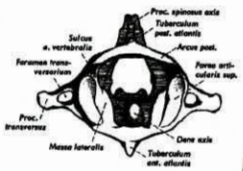
Son of Lapetos and of the okeanide Klymene



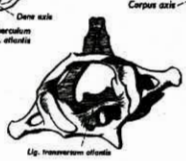
Carrying the globe

Atlas-Axis-system, different positions

Atlas and Axis, cranial view



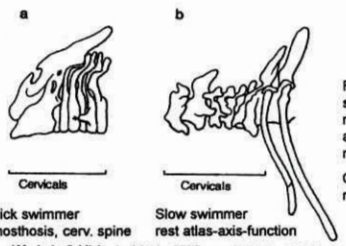
Atlas and Axis, view from dorsolateral



Turned atlas, fixed dens axis

Dens-axis construction

Involution in the aqua re-adapted mammalians



Quick swimmer synosthosis, cerv. spine

Slow swimmer rest atlas-axis-function

Free motion of cervical spine of the terrestic mammalians lost in aqua-re-adapted mammalians

Only restricted movement possible

Abb. 4 a, b. Seitliche Ansicht der HWS von **a** Delphinus delphis (schneller Hochseeschwimmer) **b** Platanista gangetica (langsamerer Flußbewohner) (Nach Pilleri)

Vulnerability of the human vertebral spine

incompleted development of lattice tower position, high vulnerability of axis-dens-system

- overloaded due to unphysiological position (industrial life), typical symptoms of cervical spine and lumbar region (Mumenthaler, Schliack)
- psychological factors, influencing regional dysfunction of vertebral spine, mainly upper part
- motion trauma of cervical spine (whiplash injury), mostly including the other parts of vertebral spine (typical acute symptoms, sometimes long-lasting dysfunction, sometimes defect states)

Cervicogenic headache (tension headache)

Symptomatology

- Pressure headache, from neck to occipital, mostly to the forehead, both sides, seldom one side,
- Helm-feeling, sometimes ring-shaped feeling
- Pressure feeling in the orbita
- Increase of headaches during coughing, unpleasant position of head and body, during fever state
- Starting possible due to external influence
  local cooling, trauma of vertebral spine, etc.
- Additional symptoms:
  - pain in C2 with dysesthesia
  - pseudo-trigeminal pain
  - atypical face pain

Cervicogenic headache

- Neurological findings
  - Dysesthesia on scalp, one side, both sides
  - Dysesthesia in C2 (sometimes)
  - Dysesthesia in trigeminal area (sometimes) first branch or all branches, one side, both sides
  - Pressure pain occipital, one side, both sides
- Neuro-orthopaedic findings
  - blockage occipital/C1, C1/2
  - tensed region upper neck part
  - pressure pain paraspinal upper cervical spine
  - stretch-position of cervical spine
  - dysfunction of other vertebral spine

Cervicogenic headache Differential diagnosis (I)

- Occipital neuralgia, (over diagnosed, Mumenthaler, 1970)
  - differentiation to cervicogenic headache clinically not possible
    - Insertiontendinosis of neck muscles
    - local zones of hyperalgesia
    - often disturbances of occipital joints
- Tension headache, real form
  - differentiation to vertebragenic headache clinically not possible
  - diagnosis only acceptable:
    - no signs of cervico-occipital irritation
    - no signs of cervical irritation
    - no effect after special vertebral treatment
    - psychic irritation

Cervicogenic headache Differential diagnosis (II) Vasomotoric headache

- Migraine cervicale (old terminology)
- Migraine (different forms)

- Cluster headache
  - Erythroprosopalgia = Horton neuralgia
  - Chronic paroxysmal Hemicrania (CPH)
  - Hemicrania continua (HC)

- Rare vasomotoric headache
  - Ice cream headache
  - coughing headache
  - Carotidodynia

Upper cervical syndrome

- Combined symptoms
  - Cervicogenic headache
  - Cervicalgia
  - Migraine cervicale (old terminology)
  - Cervicogenic dizziness
    attacks of vertigo, spontaneous or due to quick head movement
  - in addition:
    middle and lower cervicale syndrome
    cervico-dorsalgia, dorsalgia, lumbalgia
    combination with pseudo-radicular symptoms

Cervicogenic headache Examination program

- Neurological examination
- Manual examination, functional state of vertebral spine, especially cervical spine
- Examination of malstereotypias of body position and body movement
- X-ray of cervical spine with functional radiogram
- X-ray of the additional vertebral spine
- Cervical MRI

X-ray cervical spine

female patient, 47a

diagnosis: cervicogenic headache

a) Retroflexion, blockage upper part, dysbalance occipito-atlanto-axial joint

b) Anteroflexion, blockage in upper part and lower part of cervical spine

Cervical MRI

female patient, 47ª
diagnosis: cervicogenic headache

Stretch-position of cervical spine, mostly upper part, multisegmental disc protrusion, incipient vertebrostenosis C5/C6

Cervicogenic headache
Therapy program

- Deblockage of blocked cervical spine motion segments, using manual therapeutic methods, mainly postisometric relaxation (Lewit)
- Physio-therapy program for correction of malposition and malstereotypias
- Physio-therapy program for correction of insufficient neck muscles and vertebragen muscles
- Local infiltration of tensed muscle areas, tendomyogelosis, etc.,
  - Xyloneural
  - "Tilscher scheme"
- Drug treatment
  - Muscle relaxantia, analgetica, etc.

From tetrapods to homo sedens
high vulnerability of the cervical spine to direct impacts and to malfunction due to the industrial life

Die Aufrichtung und Entwicklung des Menschen vom "Homo erectus" zum "Homo sedens".

>>> POSTER PRESENTATIONS / POSTEROVÉ PREZENTACE

1. A. Krobot, J. Macháč, D. Horák (Olomouc)
   Morfogenetická variabilita „crista ilica" a funkční konsekvence k LBP a lumbální spinální stenóze

2. A. Loskotová (Vysoké Mýto)
   Synergismus technik myoskeletální medicíny a manuální lymfodrenáže v komplexní terapii popáleninového traumatu

3. A. Perdan (Trenčín)
   Dynamická dekompresná revaskularizácia a modelácia hlavice BK u M. Calve Legg Perthes

>>> PARTICIPATING COMPANIES / ZÚČASTNĚNÉ FIRMY

BTL zdravotnická technika, a. s.

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IBI s.r.o.

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Parabel, s.r.o.

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RESI Třeboň spol. s r.o.

Roman Rousek, výroba zdravotnických lehátek a doplňků

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the Society of Myoskeletal Medicine
of the Slovak Medical Association,
member of the International Federation for Manual/Musculoskeletal Medicine (FIMM)

on

>>> A Complex Approach to the Problem of Disturbed Function of the Motor System <<<

>>> October 12 – 14, 2006 in the Regional Centre Olomouc <<<

PROGRAMME

SkMA

>>> FRIDAY, OCTOBER 13, 2006

CHAIRS: K. LEWIT, V. TOSNEROVA, L. SORFOVA

09.00–09.20 **Vlasta Tošnerová** (Czech Republic), **Ľubica Šorfová** (Slovak Republic):
Welcome to Olomouc

09.20–09.40 **Richard Ellis** (United Kingdom): Is Professor Lewit cost-effective?
(Vyplatí se Prof. Lewit?)

09.40–09.50 **Alena Kobesová** (Czech Republic), **Craig Morris** (USA):
Tribute to Prof. Lewit and Prof. Janda (Na počest Prof. Lewita a Prof. Jandy)

09.50–10.15 **Karel Lewit** (Czech Republic): 50 let rehabilitačním lékařem
(Rehabilitation doctor for 50 years)

10.15–10.45 **discussion and congratulation**

10.45–11.15 **coffee break**

CHAIRS: J. JANDOVÁ, J. VÁCEK

11.15–11.35 **Bernard Terrier** (Switzerland): International manual medicine yesterday and tomorrow
(Mezinárodní manuální medicína včera a dnes)

11.35–11.55 **Mika Hutton** (United Kingdom): The application of complexity theory to soft tissue dysfunctions
(Aplikace teorie komplexnosti na dysfunkci měkkých tkání)

11.55–12.15 **Jacob Patijn** (The Netherlands): Reproducibility studies in manual/musculoskeletal medicine-how necessary are they?
(Studie reprodukovatelnosti v manuální/myoskeletální medicíně-do jaké míry jsou nutné?)

12.15–12.45 **discussion**

12.45–13.45 **lunch break**

CHAIRS: P. KOLÁŘ, J. ROUBALOVÁ

13.45–14.05 **Pavel Kolář** (Czech Republic): Spondylolistéza: diagnostika a terapie
(Spondylolistesis: diagnosis and therapy)

14.05–14.25 **Craig Morris** (USA): Lumbopelvic motor control: updates in research and clinical practice.
(Lumbopánevní řízení pohybu: novinky ve výzkumu a klinické praxi)

14.25–14.45 **Franz Gerstenbrand, Walter Struhal** (Austria):
The vertebral spine as the human axis organ, physiological background and its pathophysiological disturbancies.
(Páteř jako osový lidský orgán, fyziologický background a jeho patofyziologické poruchy)

14.45–15.15 **discussion**

15.15–15.45 **coffee break**

CHAIRS: A. ŠNOPLOVÁ, Š. BODNÁR

15.45–16.05 **Beat Dejung** (Switzerland): Myofascial pain conceptions will help manual medicine to survive
(Koncepce myofasciální bolesti pomůže manuální medicíně přežít)

16.05–16.25 **Meinhard Berger** (Austria): Whiplash injury – myoskeletal lesion or myth?
(Whiplash injury – myoskeletální poranění nebo mýtus?)

16.25–16.45 **Neil Osborne** (United Kingdom): Whiplash: I can see it in your eyes
(Whiplash injury: vidím to ve vašich očích)

16.45–17.05 **Clayton Skaggs** (USA): Masticatory muscle function: new considerations in neck and jaw rehabilitation
(Funkce žvýkacího svalu: nové úvahy o rehabilitaci krku a čelisti)

17.05–17.35 **discussion**

19.30–22.00 **Welcome party / Společenský večer**

>>> SATURDAY, OCTOBER 14, 2006

CHAIRS: A. KOBESOVÁ, J. JANDOVÁ

09.00–09.20 **Mark Webster** (United Kingdom): The art of assessment & therapeutic manual skills – a critical update
(Umění manuálního vyšetření a terapeutických dovedností – kritická aktualizace)

09.20–09.30 **Jesper Andersen** (Denmark): Influence of the Prague School of thought on chiropractors in Denmark, and some visions
(Vliv myšlení pražské školy na chiropraktiky v Dánsku, některé vize)

09.30–09.50 **Niels Gruniet-Nilsson** (Denmark): Physical treatments of chronic headache – a Cochrane review of the evidence
(Fyzikální léčba chronické bolesti hlavy – přehled průkazů v Cochranově databázi)

09.50–10.10 **Hans van Helvoirt** (The Netherlands): Mechanical diagnostics and therapy in manual medicine
(Mechanická diagnostika a terapie v manipulační medicíně)

10.10–10.30 **Clayton Skaggs** (USA): A Functional model for treating musculoskeletal pain in pregnancy
(Funkční model pro léčbu muskuloskeletálních bolestí v těhotenství)

10.30–11.00 **discussion**

11.00–11.30 **coffee break**

CHAIRS: K. VÉLE, P. PUKSA

11.30–11.50 **Helena Hermachová** (Austria): About the feet again.
More about stability of the feet
(Znovu o chodidle. Něco navíc o stabilitě chodidla)

11.50–12.10 **Magdalena Lepšíková, Karel Lewit** (Czech Republic): Role chodidla ve stabilizačním systému
(Role of the feet for the stabilizing system)

12.10–12.30 **František Véle** (Czech Republic): Role nervového systému v motorice člověka
(The importance of the nervous system for motor activity)

12.30–13.00 **discussion**

13.00–14.00 **lunch break**

CHAIRS: V. TOŠNEROVÁ, E. JANÍKOVÁ

14.00–14.15 **A. Lahme** (Germany): Overuse problems of the hand and wrist with musicians
(Problematika přetížení ruky a zápěstí u hudebníků)

14.15–14.25 **E. Durišová, E. Rexová, P. Rexa, J. Zvarka** (Slovak Republic):
Ovplyvniteľné rizikové faktory osteoporózy a funkčná patológia
(Risk factors in osteoporosis and its functional pathology)

14.25–14.35 **L. Marič, K. Novotná** (Czech Republic): Vliv léčebné tělovýchovy ve vodě na léčbu bolestivých stavů ramenního kloubu
(Influence of the hydrokinesiotherapy on treatment of the painful shoulder)

14.35–15.00 **discussion**

Closing of the conference