

Biomechanic - Loading Tests with Cadavers

Section - Spinal Column

Dissection Technique, Description of Injuries, Evaluation of Injuries, Preparation for the Loading Test and Selection Criteria of the Test Subjects

R. Mattern, Gg. Schmidt and D. Kallieris

University of Heidelberg

1. Procedure of Dissection

1.1. Dissection Technique

The goal is to isolate in one piece the complete spinal column with the back half of the base of the skull in connection while preserving the body form and the facial skull.

1.1.1. At first the back side of the cadaver is prepared; skin and the fatty tissue of the skin are freed over neck, back and buttocks from median incision up to the flank area so that the superficial rear muscular system inclusive the spinal processes and the arc parts of the spine can be examined visually and palpated.

1.1.2. After closing the suture of the rear skin the dissection is conducted in the usual way from the front with the opening of the head-, chest- and abdominal cavity. Skin and the fatty tissue of the skin are prepared from the median incision up to the flank until connection is reached to the preparation front at the back side. At the neck a bowing incision from the processus mastoideus of one side is made over the upper edge of the sternum to the mastoid of the other side. This cut is lengthened over the parietal height to the preparation of the scalp.

- 1.1.3. After complete eventration the intervertebral disc is severed between L5 and S1.
- 1.1.4. After removing the vault of the skull the front half of the base of the skull including the facial skull is sawed off.
- 1.1.5. Now the spinal column with the backward base of the skull up to the 6th lumbar vertebrae is isolated; furthermore the thorax without sternum remains part of our preparation. The examination of the sacral and coccygeal sections takes place in situ.
- 1.1.6. Upon conclusion of the dissection a wooden stick with a cross strut in the height of the shoulder is cut to match the cadaver and is anchored at the anterior base of the skull in order to stabilize the body. It is shaped with wet cellulose to express body contours.
- 1.1.7. The spinal column - skull preparation is now prepared in detail. The muscles of the spino-humeral, the spino-costal and the autochton groups are exposed and are removed after description of our findings. The anterior and lateral neck muscles as well as the lumbar muscles are examined in the same way. In the region of the upper and lower lateral neck triangles the vessel nerve cords are exposed and then removed.
- 1.1.8. Now a bony ligamentous preparation extensively free of soft tissues is on hand which is frozen in straight position prior to further examination.
- 1.1.9. Longitudinal sections of the complete spinal column preparation including the rear base of the skull are produced by means of a band-saw in the frozen preparation in order to expose the intervertebral discs, the vertebral bodies, the canalis vertebralis and its content as well as the foramina intervertebralia and the lateral joints.
- 1.1.10. Longitudinal section in the sagittal plane of the processus spinosus.

1.1.11. Longitudinal section in the sagittal plane of the right joint processus.

1.1.12. Longitudinal section in the sagittal plane of the left joint processus.

1.2. Determination of Injuries

Methods are inspection, palpation and x-ray technique. It is essential that an experienced physician is on hand to conduct a meticulous investigation; all anatomical details are noted and each segment is examined individually.

1.2.1. The inspection takes note of hemorrhages of the soft tissues, ligaments and bony structures which can increase significantly postmortem in the area of injury. Further, due to the inspection continuity separations and form deviations of the soft tissues and bony structures are recognizable.

1.2.2. The palpation can uncover abnormal flexibility of ligamentous connections, bones and bony processus, cartilaginous structures as well as continuity separations of the soft tissues (muscle facie, muscles, ligaments). The examination of saw sections through compression and traction has to wait until the preparation has thawed out.

1.2.3. Intact and destroyed structures of the bones, also in the planes not exposed by the saw section are documented by means of x-rays. By injection of contrast fluid in the vertebral arteries vessel lacerations of this vessel in its course within the vertebral transversus processus can be uncovered. The x-ray of the bony ligamentous preparation allows a very exact diagnosis. Radiograms in certain bending angles can give further information about discreet injuries.

2. Description of Injuries and Evaluation

2.2.1. The injured anatomical structure and the kind of injury is mentioned in the description of the injuries, i.e., hemorrhage, laceration, fracture, luxation, suppression, etc. The extent of the injury is recorded as necessary, i.e., the extent of a hemorrhage, of a laceration or a fracture, the extension of a luxation, etc.

2.1.2. The injury findings are recorded and transferred into a model of the spinal column including its soft tissues (Fig. 1).

2.2. The evaluation of the injury complies to the AIS (1976 Revision) in accordance with entries of the injury scale dictionary:

2.2.1. Cervical spine.

2.2.2. Thoracic spine.

2.2.3. And analogous, lumbar spine.

2.2.4. As far as the injuries are not recorded in the injury scale dictionary they will be evaluated according to the Abbreviated Injury Scale by body region.

3. Preparation of the Spinal Column Prior to the Test

3.1. At the lateral area of the body surface targets are affixed to enable analysis and draw conclusions from the position and behavior of the spinal column in the cinematographical analysis of the high-speed films taken during the test. Up to now a further preparation has not been conducted

3.2. As far as the spinal column is loaded while destroying rigor mortis by force in the extremities one can assume that rigor mortis of spinal column muscles has also ceased.

4. Selection Criteria of the Test Subjects.

4.1. On principle, only cadavers can be used who are not injured. All test subjects with noticeable injuries which could have effects on the spinal column are to be excluded from the test. The preliminary examination is made by inspection, palpation and x-rays.

4.2. By the inquiry of the pre-history the circumstances of death are recorded in order to obtain information of possible injuries and help direct examinations.

4.3. Only fresh unembalmed cadavers are used. The test takes place approximately 36 hours after death. The cadaver is stored in the Institute by a temperature of 4-8°C.

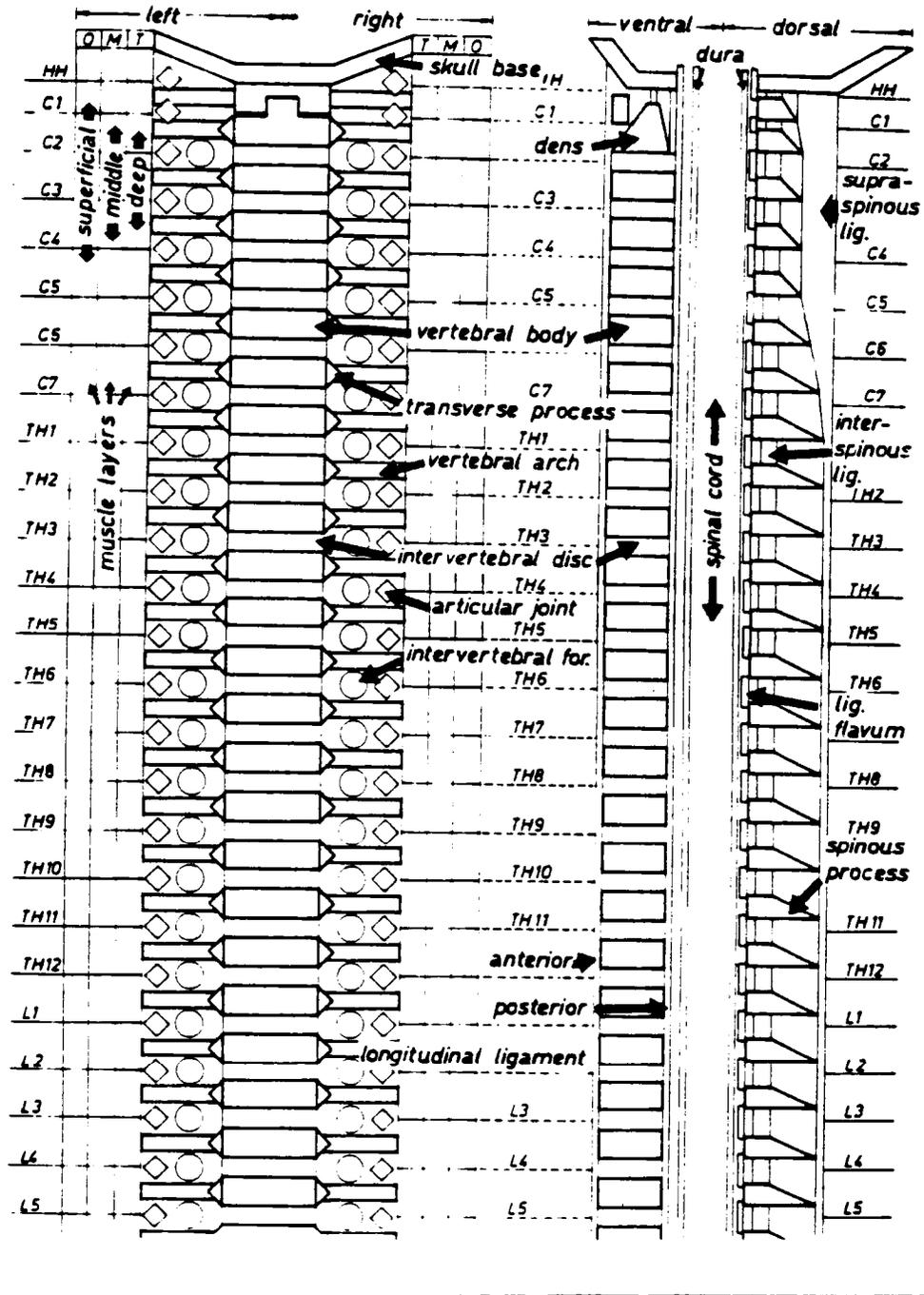


Fig. 1 Schematic Presentation of the Spine and its Structural Components of Facilitate the Documentation of Injuries