E-Learning Applications
for
Basic and Advanced Education in
Medicine and Dentistry

Herbert K. Matthies

Peter L. Reichertz Institute for Medical Informatics (PLRI)
Hannover Medical School, Hannover, Germany

http://www.plri.de/
The Peter L. Reichertz Institute for Medical Informatics

The University of Braunschweig - Institute of Technology and the Hannover Medical School has been united their medical informatics institutes as a joint institute, named “Peter L. Reichertz Institute for Medical Informatics“ (PLRI).

PLRI consists of two institutes, located
  • at Braunschweig (director: Prof. R. Haux)
  • at Hannover (director: Prof. H. K. Matthies).

→ Aim: regional 'center of excellence'
Peter L. Reichertz
(1930-1987)

a pioneer of Medical Informatics

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University of Braunschweig - Institute of Technology
and Hannover Medical School, Germany
The Peter L. Reichertz Institute for Medical Informatics

The PLRI staff is member of both universities.
The Peter L. Reichertz Institute for Medical Informatics

PLRI – education

medical informatics courses for students of
• business information technology (TU)
• computer & communication engineering (TU)
• computer science (TU)
• medicine (MHH)
• dental medicine (MHH)

medical informatics program (B.Sc., M.Sc., PhD)
at TU Braunschweig
The Peter L. Reichertz Institute for Medical Informatics

PLRI – fields of research

- health-enabling technologies
  (R. Haux, Braunschweig)

- eLearning in medicine and dentistry
  (H.K. Matthies, Hannover)

- health information systems and management
  (R. Haux, Braunschweig)

- medical imaging and visualization
  (H.K. Matthies, Hannover)
G7 GHAP, Tokyo 1998
(Global Healthcare Applications Project)

International Online Academy + SIPP (Sub-project #10)

Medical Image Reference Center (Sub-Project #9)
for Images of Neurological and Neuromuscular Diseases
at the Medical School of Hannover (Germany)

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Virtual Education System for Brain Diseases
Virtual Education System for Brain Diseases
Web and New Information and Communication Technologies

- dramatic changes of business, live, learn
New Ways of Education

New educational concepts, technologies, course contents will be required:

- teaching/learning strategies
- eLearning environments (LMS, CMS)
- blended learning courses (both face to face and eLearning)
- development and production of learning modules
- web-based learning resources/tools
- virtual learning labs/classrooms in conventional universities
- collaborative learning in small groups
- public private partnerships (PPP) between universities and publishing companies
- policies, ethics and worldwide standards
eLearning Requirements at the Hannover Medical School (MHH)

- Implementation of the model curriculum “HannibaL”: a more patient oriented approach to teaching medicine leads to special requirements concerning eLearning
- Additional ways to convey knowledge have to be found for continuing medical education
- Various departments (not necessarily medical) want to use eLearning
eLearning at the MHH

- To fulfill all requirements, "eLearning" at the MHH includes different variants of
  - computer based (not limited to web applications),
  - interactive,
  - multimedia,
  - …
  - learning methods

- It is in use in various areas:
  - education, organizational needs, technical, …
eLearning in Medicine Requires an Interdisciplinary Approach

Specialties:
- Medical Informatics
  (or Computer Science)
- Didactics

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History of eLearning at the MHH

Grantor:
Lower Saxony, Germany

The combination of Schoolbook and ILIAS

CranioTrainer

Model curriculum "HannibaL" for Medicine

Start of ILIAS at the MHH
Orthodontics in ILIAS
Chemistry in ILIAS
Biochemistry in ILIAS

Schoolbook Neuroradiology
Schoolbook Dentistry
Schoolbook Internal Medicine

Schoolbook Neuropathology
Schoolbook Caselibrary
Schoolbook Long Distance X-Ray

Schoolbook Trauma Surgery
Schoolbook Cell Biology

First implementation of Schoolbook

TT-Net
ELAN I
ELAN II
ELAN III (eSIM)

2001 2002 2003 2004 2005 2006 2007 2008

Continual training of content authors

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eLearning at the Hannover Medical School

● Examples for different eLearning implementations currently in use:
  – Web-based
    ● ILIAS: Learning management system
    ● Schoolbook: Content management system including medical case libraries for different specialities
  – Interactive training software
    ● CranioTrain: Craniotomy training for neurosurgery and trauma surgery
  – e-Examination software
    ● Q-exam
Web-based: ILIAS and Schoolbook

**ILIAS**
- Learning management system
- Portal system for learning, communication and organizational issues
- Modules are built according to the curriculum

**Schoolbook**
- Content management system
- Medical case library
- Uses semantic networks internally to allow access to content using different pathways:
  - “Networked Knowledge”

- Open source
- Assign user and author rights according to rights management
- Web-based access for learners and authors
- LAMP: Linux, Apache, MySQL, PHP
Web-based eLearning – ILIAS

● Developed at the
  University of Colonia (Germany):  http://www.ilias.de/
  + Military Univ. Hamburg

● at the MHH, ILIAS is used for developing content for
  – the model curriculum "HannibaL"
  – continuing medical education as well as
  – various projects for other (medical) professionals

● at the NATO for military education
ILIAS – Organization of Modules for HannibaL

(1st, 2nd, 3rd, ... year)
ILIAS – Organization of Modules for HannibaL
ILIAS – Dentistry / Concepts for Occlusion

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EKG - Das Signal (1/3)

Kontraktionszyklus des Herzens:

![EKG diagram](image-url)
Blood pressure data transfer via NFC
(Near Field Communication)

**Messwertliste**

**MiH, Hauspatient1, männlich**

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<th>Datum / Uhrzeit</th>
<th>Systolischer Blutdruck</th>
<th>Diastolischer Blutdruck</th>
<th>Herzfrequenz (Pals)</th>
<th>Gewicht</th>
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Sie sehen Eintrag 1 bis 10 von 18

- Systole
- Diastole
- Median systole
- Median diastole
Integration of images, multimedia content, formulae, etc. is a required feature.
Web-based eLearning – Schoolbook

- Developed by the PLRI (Hannover Medical School) ([http://www.medicalschoolbook.de/project/](http://www.medicalschoolbook.de/project/))
- Is used in various settings
  - Within the classroom (lectures)
  - Blended learning seminars (see – hear – train)
  - Learning at home
  - ...
- Advantage over other solutions:
  - Content can be interlinked in a unique way to support the "medical way of thinking"
86 year old woman with pain and dyspnea

- Pulmonary embolism
- Lung diseases
- Heart diseases
- Heart failure
- Dyspnea
- Coughing
- Chest pain
- Analgesics
- Morphine
- Tylenol

Semantic network
Fällebeispiele
Erkrankung: Lungenembolie

86-jährige Frau mit Luftnot und Schmerzen

Anamnese | Diagnostische Überlegungen | Körperliche Untersuchung | Diagnostik | Diagnose | Therapie

Frau L. L., geb. 3.2.1921
Die 86-jährige Rentnerin wird mit dem Notarzt in unsere Notaufnahme eingeliefert.
### Erkrankungen der Lunge

#### Lungenembolie

<table>
<thead>
<tr>
<th>Klinik</th>
<th>Pathogenese</th>
<th>Diagnostisches Vorgehen</th>
<th>Therapie</th>
</tr>
</thead>
</table>

Embolischer Verschluss einer Lungenarterie durch einen Thrombus, der sich meist aus den tiefen Bein- oder Beckenvenen, seltener aus dem rechten Herzen oder der V. cava superior löst. Außer Blutthromben kann selten auch einmal Fett, Luft oder ein Fremdkörper zur Embolie führen. Die Letalität der Lungenembolie beträgt etwa 5-10 %.

- Lungenembolien sind häufig (ca. 1-2 % aller stationären Patienten) und werden meist übersehen: Nur ca. 30 % werden vor dem Tod diagnostiziert! 70 % der tödlichen Lungenembolien verlaufen in Schüben. Deshalb muss schon bei Verdacht eine entsprechende Diagnostik durchgeführt werden.

**Symptomkomplex:** Dyspnöe | Husten | Schmerzen im Brustkorb
Medikamente: Antikoagulanten | Analgetika | Hypnotika
Fall: 80-jährige Frau mit Lassit und Schmerzen
Schoolbook – Blended Learning (also) for Continuing Medical Education

See – Hear – Train

Lectures

Demonstrations

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Schoolbook Neuroradiology

Hypoxischer Hirnschaden
AO4_018

Klinische Angaben
Schoolbook Neuroradiology

MRT vom 20.04.

Befundbericht

Beurteilung
Bild eines hypoxischen Hirnschadens mit Manifestation im Bereich der Basalganglien bds. Mäßig ausgeprägte subdurale Hygrome bds.

Klinische Angaben
Schoolbook Traumasurgery

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Schoolbook for Oral and Maxillofacial Surgery

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Interactive Training Software: CranioTrain

- In Neurosurgery or emergency medicine, determining the ideal placement of a craniotomy
  - is important during the surgery and also decisive for the outcome
  - may be complicated due to the angulation of the CT and/or MR image data
The Aim of CranioTrain

- How to correctly place a craniotomy is usually learned during training in neurosurgery or emergency surgery
  - Preliminary evaluations of learners with little experience showed very imprecise results

- Development of an interactive, software-based training concept
  - Software is supposed to help learners to "transfer" the 2D image information to the patient's 3D anatomy
CranioTrain – Skull Model

- Standard anatomical skull model A20 (plastic)
- Horizontal lines, distance 10 mm
- Vertical lines 0-360°, one line every 10°
- Additionally 8 points on the top of the skull
- Crosspoints of the grid are labeled for further reference
CranioTrain – Data Acquisition

Multislice CT

Geometry of the grid & skull is recorded with an optical tracking system
CranioTrain – Software

- Platform-independent development:
  - Windows
  - Linux
  - MacOS
  - ...

- Based on freely available programming libraries
  - FLTK (graphical user interface)
  - VTK (visualization)
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CranioTrain – Summary

- "Craniotrain" won't replace good training
- Still, it's an alternative to using anatomical specimen in training and thus saves costs
- Initial trials showed positive results for learners. Learning the correct placement needed considerably less effort.
3D Training: Knee  (563 kB)
3D Training

pelvic fractures  (1.243 kB)  coloscopy  (883 kB)

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PPP between universities and publishing companies
PPP between universities and publishing companies

http://ipj.quintessenz.de
Biomechanical evaluation of miniscrew implants in vitro

Selectively demineralized bone technique

Language: English

Authors:
Assoc. Prof. Boonsiva Suzuki, DDS, PhD, Dr. Eduardo Yugo Suzuki, DDS, PhD, Dr. Kanchana Duangsdaard, DDS, Dr. Prakam Prasothanee, DDS, Dr. Weeranuch Thong-ngarm, DDS, Dr. Sorapong Chuensombat, DDS, Department of Orthodontics, Faculty of Dentistry
Aiprun Janhom, DDS, MS, PhD, Department of Radiology, Faculty of Dentistry
Chiang Mai University, Thailand

Date/Event/Venue:
December 14th-16th, 2007
The 8th Asian Implant Orthodontic Conference (AIOC)
Taichung, Taiwan

Introduction

Bone quality plays an important role in the success of orthodontic miniscrew implants. (1, 2) The mechanical properties of bone are highly related to the mineral content, which varies widely according to function and histology. However, in vitro methods for evaluating biomechanical properties of miniscrew implants have not been reported.

Objectives

The aim of this study was to assess the biomechanical performance of miniscrew implants using bone samples which were demineralized by timed chemical immersion to alter the mineral content. (3)

Material and Methods

Sections of fresh bovine femur adult bone were selectively demineralized by timed immersion in 1% ethylenediamineticarboxylic acid (EDTA). Specimens was sectioned from the cortical bone...
Mobiles Computing in Medicine

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Mobiles Computing in Medicine

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