The International Spine Registry
EuroSpine

C. Röder, M. Neukamp, G. Perler, E. Munting, M. Aebi
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INTRODUCTION

Since the year 2000 EuroSpine – The Spine Society of Europe has been developing and enhancing a documentation system for spinal surgery in form of a registry. With Spine Tango we are meeting the growing demand to assess the safety and comparative effectiveness of surgical interventions of the spine. Only few other fields in medicine are under comparable scrutiny. Reacting to these tendencies, endeavors of pioneer clinicians and the Spine Tango team, in collaboration with the Institute for Evaluative Research in Medicine of the University of Bern, have led to the implementation of the only international spinal registry to date. The idea for Spine Tango was born a decade ago and developments and participation have constantly progressed since those days. Now, having reached a recognized status we would like to encourage national societies and individual partners to join the registry. Health and reimbursement authorities are already limiting the accessibility of our treatment modalities since we are lacking evidence in many aspects. Therefore we are offering Spine Tango as a common language to make our services visible and transparent. With a constantly increasing activity in the registry we would like to inform you about its history, its objectives and its current status.

M. Aebi
PROFILE

Spine Tango enables you to document the whole spectrum of spinal pathologies and the possible surgical and non-surgical treatment options. The generic approach of the Spine Tango documentation system is a must to reach the maximum number of participants using a common web based technology. This, in turn, reduces the potential for customizing the Tango in order to meet the individual expectations of specific users. There are, nevertheless, still a number of possibilities to parameterize the data collection processes according to the various hospital workflows in the user community. To give you the opportunity to document not only the surgical treatments, we have developed Spine Tango Conservative, which will be available as of summer 2011.

Spine Tango is an international, non-commercial system under the auspices of EuroSpine aiming at enabling national societies to control their own part of the registry. For that a technology called “national module concept” has been implemented to enhance participation options and to provide the hardware structure for appropriate security measures for patient and user privacy protection. In conclusion, Spine Tango is a unique applied medical and scientific documentation and technology solution. It is to the benefit of patients, physicians and therapists whilst generating evidence based findings to improve spinal care (1).

SSE Spine Tango: a European Spine Registry promoted by the Spine Society of Europe (SSE)
Eur Spine J 13: 661-662. DOI 10.1007/s00586-004-0868-0
NEW DEVELOPMENTS

**Spine Tango Conservative:** for the past three years we have been working on a documentation instrument for the non-surgical spinal therapies in order to complement the registry and make possible the assessment of all spinal treatments within the framework of one and the same registry. A first version of Spine Tango conservative was tested on a series of patients in 2009 and the results of this study are meanwhile available in the literature. Also, after another round of refinements the first official version of the questionnaire will go live in summer 2011. In parallel a reliability and validation study of the instrument is under way.

**Spine Tango 2011:** data analysis and new inventions in the spinal field have been the major drivers for developing the 2011 generation of the Spine Tango surgery, staged surgery and followup forms. They will be available as of summer 2011. Check out the following pages for a first impression.

**Quality report:** in our constant striving for improving the value of your data collection we do now provide the first version of a Spine Tango quality report, a comprehensive and stratified output about your interventions, followups, and outcomes. A pooled sample analysis of the 2010 Spine Tango data set is available on the Spine Tango web page.
**SPINE TANGO**

**Directions**
- Use a No. 2 soft pencil for marking.
- All questions must be answered unless otherwise indicated.
- Completely fill in boxes to record answers.

**Level of main pathology**
- Only 1 answer allowed
- Multiple answers allowed
- Mandatory questions: please specify

**Admission / Pathology**
- Only answer questions related to Main Pathology (Main Pathology "other" requires no specification).

**Specification of Main Pathology**
- Only answer questions related to Main Pathology (Main Pathology "other" requires no specification).

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### Abbreviations:
- MISS = Minimally Invasive Spine Surgery
- LISS = Less Invasive Spine Surgery
- CASS = Computer-Assisted Spine Surgery

### Surgeon Credentials
- Board cert. orthopedic
- Board certif. neuro
- Neuro in training
- Specialty spine
- W/o description
- With description

### Prophylaxis
- Intravenous
- Cocainisation
- Other

### Surgical Measures

#### Decompression
- Anterior partial
- Posterior partial
- Other

#### Fusion promoting meas.
- Interbody fusion (ALIF)
- Interbody fusion (PLIF)
- Interbody fusion (TLIF)
- Other

#### Stabilization rigid
- Spine stabilized with cage
- Spine stabilized with auto-biograft
- Vertebrectomy
- Other

#### Stabilization flexible
- Disc replacement
- Dynamic stabilization
- Other

### Percutan. measures
- Facetectomy
- Laminectomy
- Facet joint resection partial
- Other

### Fusion material
- Bone graft
- Autograft
- Autol. bone locally procured
- Allograft bone
- BMP or similar
- Other

### Extent of surgery - indicate as:
- From cranial to caudal:
  - SA = sacrum
  - CO = coccyx
- From cranial to caudal:
  - From 1 to 5 segments
  - From 6 to 10 segments
- From 11 to 15 segments
- From 16 to 20 segments
- From 21 to 25 segments

### Intraop surgical complications
- Vascular injury
- Neuraxial injury
- Motor dysfunction
- Sensory dysfunction
- Vascular injury
- Other

### Surgical measures during index surgery
- Vascular injury
- Neuraxial injury
- Motor dysfunction
- Sensory dysfunction
- Other

### Intraop general complications
- None
- Anaesthesiological
- Cardiovascular
- Pulmonary
- Other

### Hospital stay

#### Postop surgic compl. before discharge
- None
- Spinal fluid leak
- CSF leak / pseudomeningoele
- Motor dysfunction
- Sensory dysfunction
- Bowel / bladder dysfunction
- Other

#### Postop general compl. before discharge
- None
- Cardiovascular
- Pulmonary
- Neurological
- Other

### Re-intervention after index surgery
- None
- Neuraxial injury
- Other

### Hospital stay

#### Day
- Unventur
- Extended stay
- Resolved
- Persisting
- Achieved
- Not achieved
- No

#### Month
- ICU 2 days
- Not documented
- Thrombembolism
- Death
- Other

### Surgical Goals
- For article numbers or multiple implants use form "Implant documentation"
- Sensory improvement
- Functional improvement
- Neuro in training
- Board certified neuro
- Board certif. orthopaedic
- Specialized spine
- Other

### Location in spine, choose at least one!

#### Anterior access
- No anterior access
- Transoral
- Transforaminal
- Anterolateral
- Transcervical, anterolateral
- Transcervical, transcervical
- Trans-c, trans-s (XLIF)
- Other

#### Posterior access
- No posterior access
- Transpedicular
- Para-coccygeal (AxIALIF)
- Other

### Therapeutic Goals upon discharge
- FU foreseen
- Partially achieved
- Achieved
- Not achieved
- No
**Follow-up form 2011 draft**

**physician based, single sided**

---

**Directions**
- Use a 2B soft pencil for marking.
- All answers must be entered with the web interface.
- Completely fill in boxes to record answers.

**Question types**
- Only one answer allowed
- Please specify multiple answers allowed
- Mandatory information

**Questionnaire**

<table>
<thead>
<tr>
<th>Question</th>
<th>Options</th>
</tr>
</thead>
<tbody>
<tr>
<td>Complications</td>
<td>sensory dysfunction, motor dysfunction, bowel/bladder dysfunction, non-union, implant failure, CSF leak/pseudomeningocele, wound infection superficial</td>
</tr>
<tr>
<td>Therapeutic consequences</td>
<td>none, non-operative inpatient, non-operative outpatient, other</td>
</tr>
<tr>
<td>Individual consequences</td>
<td>increased pain, prolonged impairment, reduced social activities, permanent impairment, other</td>
</tr>
</tbody>
</table>

---

**Follow-up**

<table>
<thead>
<tr>
<th>Day</th>
<th>Follow up interval</th>
<th>Work status</th>
<th>Therap. goals/measures partially achieved</th>
<th>Therapeutic goals/measures not achieved</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>&gt; 6 weeks</td>
<td>not at work since OP</td>
<td>none</td>
<td>none</td>
</tr>
<tr>
<td>2</td>
<td>&gt; 3 months</td>
<td>started partially, same job</td>
<td>axial pain relief</td>
<td>axial pain relief</td>
</tr>
<tr>
<td>3</td>
<td>&gt; 6 months</td>
<td>fully reintegrated</td>
<td>peripheral pain relief</td>
<td>peripheral pain relief</td>
</tr>
<tr>
<td></td>
<td>(Ex. 4 months=0.33 yrs.)</td>
<td>resumed work, but quit again</td>
<td>functional improvement</td>
<td>functional improvement</td>
</tr>
</tbody>
</table>

---

**Therapeutic goals/measures achieved**

<table>
<thead>
<tr>
<th>Goal</th>
<th>Achieved</th>
</tr>
</thead>
<tbody>
<tr>
<td>axial pain relief</td>
<td></td>
</tr>
<tr>
<td>peripheral pain relief</td>
<td></td>
</tr>
<tr>
<td>functional improvement</td>
<td></td>
</tr>
<tr>
<td>motor improvement</td>
<td></td>
</tr>
<tr>
<td>sensory improvement</td>
<td></td>
</tr>
<tr>
<td>bladder/rectal function improvement</td>
<td></td>
</tr>
<tr>
<td>spinal stabilization</td>
<td></td>
</tr>
<tr>
<td>stop deformity progression</td>
<td></td>
</tr>
<tr>
<td>prophylactic decompression</td>
<td></td>
</tr>
<tr>
<td>cosmetic improvement</td>
<td></td>
</tr>
<tr>
<td>diagnostic measures</td>
<td></td>
</tr>
</tbody>
</table>

**Medication for spinal surgery/pathology**

<table>
<thead>
<tr>
<th>Medication</th>
<th>Achieved</th>
</tr>
</thead>
<tbody>
<tr>
<td>NSAIDs, Paracetamol (WHO I)</td>
<td></td>
</tr>
<tr>
<td>strong opioids (WHO III)</td>
<td></td>
</tr>
<tr>
<td>vitamin B complex</td>
<td></td>
</tr>
<tr>
<td>weak opioids (WHO II)</td>
<td></td>
</tr>
<tr>
<td>antidepressives</td>
<td></td>
</tr>
<tr>
<td>other</td>
<td></td>
</tr>
</tbody>
</table>

**Rehabilitation**

<table>
<thead>
<tr>
<th>Rehabilitation</th>
<th>Achieved</th>
</tr>
</thead>
<tbody>
<tr>
<td>none</td>
<td></td>
</tr>
<tr>
<td>outpatient rehab / physio</td>
<td></td>
</tr>
<tr>
<td>inpatient rehab / physio</td>
<td></td>
</tr>
</tbody>
</table>

**Comments regarding follow-up**

---

**Complications**

<table>
<thead>
<tr>
<th>Type</th>
<th>Achieved</th>
</tr>
</thead>
<tbody>
<tr>
<td>sensory dysfunction</td>
<td></td>
</tr>
<tr>
<td>motor dysfunction</td>
<td></td>
</tr>
<tr>
<td>bowel/bladder dysfunction</td>
<td></td>
</tr>
<tr>
<td>non-union</td>
<td></td>
</tr>
<tr>
<td>implant failure</td>
<td></td>
</tr>
<tr>
<td>CSF leak/pseudomeningocele</td>
<td></td>
</tr>
<tr>
<td>wound infection superficial</td>
<td></td>
</tr>
</tbody>
</table>

**Therapeutic consequences**

<table>
<thead>
<tr>
<th>Consequence</th>
<th>Achieved</th>
</tr>
</thead>
<tbody>
<tr>
<td>None</td>
<td></td>
</tr>
<tr>
<td>non-operative inpatient</td>
<td></td>
</tr>
<tr>
<td>non-operative outpatient</td>
<td></td>
</tr>
<tr>
<td>other</td>
<td></td>
</tr>
</tbody>
</table>

**Individual consequences**

<table>
<thead>
<tr>
<th>Consequence</th>
<th>Achieved</th>
</tr>
</thead>
<tbody>
<tr>
<td>Increased pain</td>
<td></td>
</tr>
<tr>
<td>Protracted impairment</td>
<td></td>
</tr>
<tr>
<td>Reduced social activities</td>
<td></td>
</tr>
<tr>
<td>Permanent impairment</td>
<td></td>
</tr>
</tbody>
</table>

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Surgery staged 2011 draft
front and back side

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**SPINE TANGO**

**SURGERY**

**Staged**

<table>
<thead>
<tr>
<th>Question type</th>
</tr>
</thead>
<tbody>
<tr>
<td>All answers allowed</td>
</tr>
<tr>
<td>Competition if 0 to 100 answers received</td>
</tr>
<tr>
<td>Level of procedure</td>
</tr>
<tr>
<td>Mid to lower cervical</td>
</tr>
<tr>
<td>Mid to lower thoracic/upper lumbar</td>
</tr>
<tr>
<td>Mid to lower lumbar</td>
</tr>
<tr>
<td>Sacral</td>
</tr>
</tbody>
</table>

**Admission**

<table>
<thead>
<tr>
<th>Main pathology</th>
</tr>
</thead>
<tbody>
<tr>
<td>Answer &quot;same as stage I surgery&quot; excludes options &quot;Specification of Main Pathology&quot; and &quot;Previous treatment for main pathology&quot;</td>
</tr>
<tr>
<td>Deformity</td>
</tr>
<tr>
<td>Degen. disease</td>
</tr>
<tr>
<td>Pathological Type of degeneration</td>
</tr>
<tr>
<td>degenerative disease</td>
</tr>
<tr>
<td>only 1 answer allowed</td>
</tr>
<tr>
<td>Specify grade of spondyl.</td>
</tr>
<tr>
<td>Type of spondylolisthesis</td>
</tr>
<tr>
<td>Primary benign</td>
</tr>
<tr>
<td>Primary malignant</td>
</tr>
<tr>
<td>metastatic malignant</td>
</tr>
<tr>
<td>Secondary malignant</td>
</tr>
<tr>
<td>Type of tumor location</td>
</tr>
<tr>
<td>Extent of spondylolisthesis</td>
</tr>
<tr>
<td>Treatment effects</td>
</tr>
<tr>
<td>Type of tumor</td>
</tr>
<tr>
<td>Type of pathology (fracture/trauma)</td>
</tr>
<tr>
<td>Fracture type</td>
</tr>
<tr>
<td>C3-C5/6/7/AD</td>
</tr>
<tr>
<td>C1-C2/1st digit</td>
</tr>
<tr>
<td>C3-C7</td>
</tr>
<tr>
<td>C1-C2/1st digit</td>
</tr>
<tr>
<td>CBA</td>
</tr>
<tr>
<td>CBA</td>
</tr>
<tr>
<td>Internal Use Only - Not read by scanner</td>
</tr>
</tbody>
</table>

**Admission**

| Type of pathology (fracture/trauma) |
| Fracture type |
| C1-C2/1st digit |
| C3-C5/6/7/AD |
| C1-C2/1st digit |
| C3-C5/6/7/AD |
| C1-C2/1st digit |
| C3-C5/6/7/AD |
| C1-C2/1st digit |
| C3-C5/6/7/AD |
| C1-C2/1st digit |
| C3-C5/6/7/AD |
| C1-C2/1st digit |
| C3-C5/6/7/AD |
| C1-C2/1st digit |
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| C1-C2/1st digit |
| C3-C5/6/7/AD |
| C1-C2/1st digit |
| C3-C5/6/7/AD |
| C1-C2/1st digit |
| C3-C5/6/7/AD |
| C1-C2/1st digit |
| C3-C5/6/7/AD |
| C1-C2/1st digit |
APPLICATION

Quality control, comparative effectiveness and outcomes research, postmarket surveillance of implants, national and international study network

**Internal quality control**: assuming that you have a complete data collection Spine Tango enables you to monitor all types of surgery during a specific period, observing the date and duration of operation, patient characteristics and outcomes (patient and physician based).

**External quality control**: Benchmarking, the comparison of own performance with that of the national or international results in the Tango data pool is a powerful management tool because it overcomes "paradigm blindness." Paradigm blindness can be summed up as the mode of thinking, “The way we do it is the best because this is the way we’ve always done it.” Benchmarking opens organizations to new methods, ideas and tools to improve their effectiveness. It helps overcome resistance to change by presenting successful methods of problem solving that are different to the ones currently employed. Enabling benchmarking possibilities is one of the fundamental goals of the Spine Tango venture.
Outcomes research: this aspect is actually just taking a different view for the same basic activity, i.e. the systematic and prospective collection of key data regarding interventions and outcomes for and of spinal pathologies. While quality assurance is rather used for the purposes of improving ones’ own standards of care, outcomes research wants to generate new medical and scientific knowledge and make it available in the peer-reviewed literature.

Postmarket surveillance of implants: implants play a major role in modern spine surgery and just like in the domains of total joint arthroplasty their true performance can only be evaluated by systematically following the devices after implantation and documenting their outcomes in large clinical databases like the Tango.

National and international study network: the Tango is a technology backbone and currently networks about 50 active hospitals in Europe, North and South America, Australia and Asia. This provides a great opportunity for national and international multicenter studies that piggyback on the ongoing routine data collection, add some hypothesis based questions and collect this extra information for the time of primary and followup data collection as specified in the joint study protocol.
DATA ENTRY

There are 4 possible ways forms and questionnaires can be transferred to the database (figure 1):

1. Online data entry via the web-interface (no software to be installed).
2. OMR (Optical Mark Reader) i.e. scanner-assisted entry of paper forms.
3. Paper based data capture with mailing to the IEFM or other partner institutions for OMR scanner-assisted entry of paper forms.
4. Hybrid method of online data entry and OMR scanner-assisted entry of paper forms (not pictured).

In the rectangles multiple methods of gathering patient and physician generated data are shown (by mail, inhouse, outpatient clinics, telephone and new electronic media). The goal to generate a comprehensive database is achieved by collecting data of the patient layer and the clinic/physician layer. Having created a consistent data set the options of analyses are almost unlimited. Outcome evaluation can now be done in particular.

Figure 1: Spine Tango methods of data entry
A COMPLETE CASE

Following Ernest Codman’s “end result system” the result of a surgical intervention should be recorded if the outcome can be considered as definitive (2). In most cases of spinal surgery, this can be done after a minimum of 3 months after surgery as demonstrated by Mannion et al (3). In accordance with figure 02. EuroSpine encourages one physician and patient based followup in the first year after surgery, ideally later than 3 months postop, and further, at least patient based followups around year one and two after surgery. The registration of complications at any time during the postoperative period is self understood. Patient based outcome documentation with the COMI (Core Outcome Measure Index) questionnaires for neck and back pain has become an essential part of the Spine Tango documentation (4). Figure 03 on the next page illustrates the ideal case of a completely documented treatment (5).


Figure 2: Patient based outcome documentation with the COMI (Core Outcome Measure Index) questionnaires, AF Mannion et al. (2009)(3)
Apart from the preoperative assessment of patients’ quality of life and the recording of the surgical intervention, the Spine Tango code of conduct recommends one physician and patient based followup around the 3 months postoperative time interval. In accordance with international standards in the medical literature, an additional and at least patient based followup for the followup intervals 1 year and 2 years is highly desirable. If a surgeon based followup can also be achieved, a perfect outcome documentation is in place.
### SPINE TANGO

#### Directions
- Use a #2 soft pencil for marking.
- All questions must be answered unless otherwise indicated.
- Completely fill in boxes to record answers.

#### Question types
- only 1 answer allowed
- multiple answers allowed
- mandatory questions

#### Level of procedure

<table>
<thead>
<tr>
<th>C</th>
<th>upper cervical</th>
<th>C</th>
<th>cervicothoracic</th>
<th>C</th>
<th>thoracic</th>
<th>C</th>
<th>thoracolumbar</th>
<th>C</th>
<th>lumbosacral</th>
<th>C</th>
<th>sacral</th>
</tr>
</thead>
</table>

#### Extent of lesion

| C | 1 segment/vertebral body | C | 2-3 segments/vertebral bodies | C | 4-5 segments/vertebral bodies | C | >6 segments/vertebral bodies |

#### Admission / Pathology

### Main pathology

- degenerative disease
- deformity
- pathological fracture
- inflammation
- failed surgery
- tumor
- other

### Specification of Main Pathology

- only answer questions related to Main Pathology (Main Pathology "other" requires no specification).

### Type of degeneration

- disc herniation
- spondylolisthesis
- adjacent segment disease
- other

### Type of deformity

- scoliosis
- kyphosis
- double curve
- other

### Additional fractures and treatments require separate forms.

### Type of (pathological) fracture/trauma

- C0/D0 (C0)
- C1/D1 (C1)
- C2/D2 (C2)
- C3/D3 (C3)

### Type of failure surgery

- non-union
- tumor instability
- neurocompression
- sagittal imbalance

### Extent of lesion

- C | 1 segment/vertebral body | C | 2-3 segments/vertebral bodies | C | 4-5 segments/vertebral bodies | C | >6 segments/vertebral bodies |

### Type of pathology, fracture/trauma

- C4-L5/S1 AO fracture type
- C2
- C3
- C4
- C5
- C6
- C7
- C8
- T1
- T2
- T3
- T4
- T5
- T6
- T7
- T8
- Th1
- Th2
- Th3
- Th4
- Th5
- Th6
- Th7
- Th8
- Th9
- Th10
- Th11
- Th12
- L1
- L2
- L3
- L4
- L5
- L6
- L7
- L8
- L9
- L10
- L11
- L12
- S1
- S2
- S3
- S4
- S5
- Others

### Type of inflammation

- tuberculous
- fungal
- other

### Type of infection

- postop. infection
- implant failure
- sagittal imbalance

### Type of tumor

- vertebrectomy
- posterior bony elements
- extraspinal
- intradural extramedullary
- intradural intramedullary
- other

### Type of tumor localization

- discitis
- spondylodiscitis
- other

### Type of spondylolisthesis

- isthmic
- degenerative
- traumatic
- combined

### Type of tumor localization

- M. Scheuermann disease
- ankylosing spondylitis
- inflammatory arthritis
- M. Bechterew disease

### Type of inflammation

- ankylosing spondylitis
- inflammatory arthritis
- M. Bechterew disease

### Comments regarding main pathology:

- additional fractures and treatments require separate forms.

### Extent of lesion

- C | 1 segment/vertebral body | C | 2-3 segments/vertebral bodies | C | 4-5 segments/vertebral bodies | C | >6 segments/vertebral bodies |

### Additional pathology

- degenerative disease
- pathological fracture
- spondylolisthesis
- other

### M.R.N.

2006
### SURGERY

**Surgical Procedure**

- **SPINE TANGO**

**Surgical Measures**

- **Decompression**
  - Note: "anterior"/"posterior" refers to location of MEASURES in the spine, NOT to access!
  - discetomy
  - c-cam (posterior)
  - vertebrectomy (posterior)
  - interbody fusion between vertebrae (ant. appr.)
  - interbody fusion between vertebrae (post. appr.)
  - facet joint resection (posterior)
  - other

- **Fusion**
  - interbody fusion between vertebrae (ant. appr.)
  - interbody fusion between vertebrae (post. appr.)
  - facet joint resection (posterior)
  - other

- **Stabilization rigid**
  - interbody fusion with cage (posterior approach)
  - vertebral body replacement by cage
  - plates
  - pedicle screws with rod

- **Stabil. motion preserving**
  - disc replacement
  - facet replacement

**Blood loss**

- < 500 ml
- 500 - 1000 ml
- > 1000 ml
- not measured

**Operation time**

- < 1 hr.
- 1 - 2 hrs.
- 2 - 3 hrs.
- > 3 hrs.
- unknown

**Fusion material**

- autol. bone
- cement
- other

**Percutan. measures**

- facet block
- root block

**Surgical notes**

### Posterior access

- autol. bone
- cement

**Posterior access**

- transperitoneal
- retroperitoneal
- thoraco-phrenico-lumbotomy
- thoracotomy
- cervicothor. a.lat. w/ thoracot.

**Discharge**

<table>
<thead>
<tr>
<th>Compartment</th>
<th>Date</th>
<th>Time</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**General complications**

- cerebral
- cardiovascular
- pulmonary
- renal
- other

**Surgical complications**

- bleeding in spinal canal
- bleeding outside spinal canal
- malposition of implant
- wound infection

**Surgical intervention/re-intervention**

- metal removal
- suture
- abscess drainage
- refusion

**Surgical notes**

- conservative functional
- extended hospital stay
- other

**Status of Complications**

- resolved
- improved
- persisting
COMI (low back)
patient based assessment, front side

Back problems can lead to back pain and/or pain in the legs/buttocks, as well as to sensory disturbances such as tingling, 'pins and needles' or numbness in any of these regions.

1. Which of the following problems troubles you the most? Please tick ONE BOX only
   - back pain
   - leg/buttock pain
   - sensory disturbances in the back/leg/buttocks, e.g. tingling, 'pins and needles', numbness
   - none of the above

2. For the following 2 questions (2a and 2b) we would like you to indicate the severity of your pain, by ticking the appropriate box (where "0" = no pain, "10" = worst pain you can imagine). There are separate questions for back pain and for leg pain (sciatica)/buttock pain.
   
   2a. How severe was your back pain in the last week?
      - no pain
      - 0
      - 1
      - 2
      - 3
      - 4
      - 5
      - 6
      - 7
      - 8
      - 9
      - 10
      - worst pain that I can imagine

   2b. How severe was your leg pain (sciatica)/buttock pain in the last week?
      - no pain
      - 0
      - 1
      - 2
      - 3
      - 4
      - 5
      - 6
      - 7
      - 8
      - 9
      - 10
      - worst pain that I can imagine

3. During the past week, how much did your back problem interfere with your normal work (including both work outside the home and housework)?
   - not at all
   - a little bit
   - moderately
   - quite a bit
   - extremely

4. If you had to spend the rest of your life with the symptoms you have right now, how would you feel about it?
   - very satisfied
   - somewhat satisfied
   - neither satisfied nor dissatisfied
   - somewhat dissatisfied
   - very dissatisfied

5. Please reflect on the last week. How would you rate your quality of life?
   - very good
   - good
   - moderate
   - bad
   - very bad

Please go to the next page...
6. During the past 4 weeks, how many days did you cut down on the things you usually do (work, housework, school, recreational activities) because of your back problem?
   - none
   - between 1 and 7 days
   - between 8 and 14 days
   - between 15 and 21 days
   - more than 22 days

7. During the past 4 weeks, how many days did your back problem keep you from going to work (job, school, housework)?
   - none
   - between 1 and 7 days
   - between 8 and 14 days
   - between 15 and 21 days
   - more than 22 days

---

8a. Did any complications arise as a consequence of your operation in our hospital (e.g. problems with wound healing, paralysis, sensory disturbances)?
   - no
   - yes
     please describe these: ..............................................................

8b. How bothersome were these complications?
   - not at all bothersome
   - slightly bothersome
   - moderately bothersome
   - very bothersome
   - extremely bothersome

9. Since the operation in our hospital, have you had any further operation(s) on your lumbar spine (back) in our or in other hospitals?
   - no
   - yes, but at a different level of the spine.
   - yes, at the same level of the spine (same segment)

10. Over the course of treatment for your back problem, how satisfied were you with your overall medical care in our hospital?
    - very satisfied
    - somewhat satisfied
    - neither satisfied nor dissatisfied
    - somewhat dissatisfied
    - very dissatisfied

11. Overall, how much did the operation in our hospital help your back problem?
    - helped a lot
    - helped
    - helped only little
    - didn't help
    - made things worse

---

Date: .......................................................
Month: .......................................................
Year: .........................................................
### Follow-up

**FOLLOW-UP 2006**

#### Patient Information

- **Last name**
- **First name**
- **Gender**
- **Street**
- **City**
- **Country**
- **Zip code**
- **Telephone**
- **M.R.N.**
- **Internal Use Only**
- **Not read by scanner**

#### Level of Procedure

- upper cervical
- cervico-thoracic
- thoracic
- thoraco-lumbar
- lumbar
- lumbo-sacral
- sacral
- coccyx

#### Day

- 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
- 30
- 31

#### Month

- January
- February
- March
- April
- May
- June
- July
- August
- September
- October
- November
- December

#### Year

- 2006

#### Work status

- not at work since OP
- started partially, same job
- fully reintegrated
- resumed work, but quit again
- retired since OP
- has been dismissed
- current job
- retired before OP
- child/student
- housewife
- other

#### Follow-up interval

- 6 weeks
- 1 year
- 2 years
- other

(Ex. 4 months=0.33 yrs. (4/12))

#### Surgical goals/measures achieved

- pain relief
- functional improvement
- neurological improvement
- cosmetic improvement
- diagnostic measures
- other

#### Surgical goals/measures partially achieved

- pain relief
- functional improvement
- neurological improvement
- cosmetic improvement
- diagnostic measures
- other

#### Surgical goals/measures not achieved

- pain relief
- functional improvement
- neurological improvement
- cosmetic improvement
- diagnostic measures
- other

#### Medication

- steroids
- antibiotics
- antidepressives
- opioids
- vitamin B complex

#### Rehabilitation

- home-based
- outpatient rehab / physio
- inpatient rehab / physio
- other

#### Overall outcome (examiner)

- poor
- fair
- good
- excellent
- not applicable

#### Decision

- no further follow-up
- further follow-up
- revision foreseen
- other primary intervention foreseen

#### Complications

- sensory disturbance
- motor disturbance
- sphincter disturbance
- implant failure
- instability
- liquor fistula
- superficial wound infection
- deep subfascial wound infection
- spondylitis
- discitis
- wrong segment
- malposition of implant
- recurrence of symptoms
- graft complication
- sequelae anaesthesia
- internal medicine
- other

#### Individual consequences

- none
- increased pain
- prolonged impairment
- reduced social activities
- permanent impairment
- other

#### Therapeutic consequences

- none
- non-operative outpatient
- non-operative outpatient
- reinvention
- other

#### Comments regarding complications

- Examiner

#### Comments regarding follow-up

- no
- yes

- early, Op-day - 28 days postop
- sub-acute, 2 - 6 months
- late, > 6 months

- sensory disturbance
- motor disturbance
- sphincter disturbance
- implant failure
- instability
- liquor fistula
- superficial wound infection
- deep subfascial wound infection
- spondylitis
- discitis
- wrong segment
- malposition of implant
- recurrence of symptoms
- graft complication
- sequelae anaesthesia
- internal medicine
- other

- none
- increased pain
- prolonged impairment
- reduced social activities
- permanent impairment
- other

- early, Op-day - 28 days postop
- sub-acute, 2 - 6 months
- late, > 6 months

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Overview (Pool)
Benchmarking: USA vs. German speaking countries vs. Benelux & Scandinavia vs. “Others”
Data from the
Surgery form: demographic data, distribution and specification of diagnosis, different details related to main pathology, complications
Followup form: followup interval, overall outcome, achievement of surgical goals

Short exemplary analysis: **Spondylolisthesis** (Pool):
Demographic data
Group specification related to surgery
STATISTICS AND COMMENTS

A study of the weighting and frequency of statistical reports was published by Windish in JAMA in 2007 (6). This work comprises the study of 239 original articles in 6 journals (American Journal of Medicine, Annals of Internal Medicine, BMJ, JAMA, Lancet, New England Journal of Medicine) with regard to statistical evaluation. 91.6% of the articles included descriptive statistics and 50.2% were compiled from simple statistical methods. Multivariate analyses were used for 68.6% of the cases. All the above mentioned methodologies can be used in Spine Tango. The Spine Tango international pool offers close to 40,000 eligible cases. The number of entries increases constantly. Below you will find a short summary of all the documented surgeries in Spine Tango followed by a detailed assessment of the patient subgroup with various types of spondylolisthesis.


Spine Tango growth curves

Figure 4: Growth curves of implemented forms (primary and staged surgery and followup) over the years.
The following analyses are based on the international Spine Tango data pool using all submitted and completed forms until the end of the year 2010 (form versions 2005/06 only). For the descriptive statistics we divided the data into 4 groups for benchmarking without case-mix adjustment.

German speaking countries, USA, Scandinavia-Benelux and “Others”

The German speaking group consists of 29 hospitals, 11 from Switzerland, 16 from Germany and 2 from Austria. In the US-group we have 3 centers. In the Scandinavia/Benelux group we combined 4 Belgian hospitals 2 Finnish and 1 hospital from the Netherlands. The other 12 hospitals are located in Italy (3), Australia (2), UK (2); Mexico, Poland, Singapore, Brazil and Slovenia.

Figure 5: Hospital classification, German speaking group, (29 hospitals)

Figure 6: Hospital classification, US group, (3 hospitals)
For the hospital classification we graded the centers in each group into one of the following categories: university hospital or teaching hospital, specialized spine center, general or orthopedic hospital and private hospital. Among the four groups you can find various distributions as the figure 5-8 show. These differences may also be caused by different health care systems and nomenclatures.

In the German speaking group the specialized spine centers dominate with 41%. Two of the three US hospitals are university hospitals. Scandinavia and Benelux have mostly general or orthopedic hospitals (4 of 7 hospitals) participating. In the “Others” group we can find 4 university hospitals and only one specialized spine center.
To compare the four groups we give an overview of the demographic data for each group. For the following graphs we determined the age and gender distribution at the time of surgery. In total we could find 34382 surgeries in the database.

For all 4 groups the majority of spinal interventions happen in the four life decades between an age of 40 and 80 years. In the Scandinavia and Benelux group there is one exception with a second prominent group with patients at an age between 10 and 20 (10.3%). This is caused by one participating center performing a lot deformity surgeries in younger patients.
Comparing the US and the “Others” with the German speaking patients it seems that they have a slightly younger clientele. For the US half of the patients (50%) have an age between 40 and 60 years at surgery. Also, in the “Others” group most patients (39.9%) have their surgery between an age of 40 and 60 years. The decade with the highest value is the 5th (N=697; 21.0%). In the German speaking countries the trend shows older patients presenting for surgery. The decade with the most frequent surgeries is the 8th. The peak level is for patients with an age between 60 and 80 years at the time of surgery (44.6%).

Figure 11: Distribution of age by gender (at surgery), US group, (N= 6205)

Figure 12: Distribution of age by gender (at surgery), “Others” group, (N=3313)
The distribution of main pathology among the four groups shows a relatively equal domination of degenerative diseases as main pathology. Noticeable is a higher percentage of deformities as main pathology in the Scandinavia and Benelux countries. We can verify a deformity center in the Scandinavia and Benelux group with a higher amount of younger patients as seen before in the age distribution.
Figure 14 shows the distribution of degenerative disease as most common main pathology. In the German speaking group the most frequent specifications were disc herniation and spinal stenosis with about 47% each. Scandinavia and Benelux show a clear domination of spinal stenosis (61.5%). Disc degeneration and disc herniation and spondylarthrosis are similarly frequent (~ 34-36%). They show less black discs with 1.9% compared to 33.2% in the “Others” group or 12.6% in the US group which may also be caused by different definitions.

In the US the most frequent specifications are disc degeneration and disc herniation with over 50% each. In contrast, we found the lowest percentage of spinal stenosis in the US. In the “Others” group the disc herniation reaches the highest value (64.6%).
Decompression alone was the most frequently performed surgery for degenerative disease in the German speaking, the Scandinavia and Benelux and the “Others” group. In the US the most frequently performed surgery was decompression combined with fusion and rigid stabilisation (49.2%). Differences between health cares systems in treatment strategies for degenerative diseases may become apparent here. The analysis is, however, not adjusted for case mix.
Figure 16 shows the distribution of fracture types according to the AO-classification. Type A1 dominates in the German speaking (53.0%) and in the “Others” group (42.0%). For the Scandinavia and Benelux group the fracture types are more evenly distributed. The most frequent types are also A1 (24.4%) and A3 (21.8%). In the US the most frequent fracture types are A2 with 33.2% and B2 with 26.1%.
Degeneration as predominant etiology of deformity is most frequent in the US (58.3%) and the German speaking group (40.9%).

Scandinavia and Benelux and the “Others” group have a different main etiology for deformities with nearly 50% idiopathic etiologies each.

These numbers have to be interpreted with care, however, since non representative hospital samples and mixed hospital profiles must be considered.
There are different distributions for the four types of spondylolisthesis. In Scandinavia and Benelux, the most commonly treated form is Type II (isthmic spondylolisthesis) with 77.4%. In the US- and the German speaking group, the most frequently operated spondylolisthesis is of Type III (degenerative) with 74.7% and 61.6%. In the “Others”-group, Types II and III are equally distributed with around 41% each.

Types IV, V, and VI are barely found in any of the country groups.

Further analysis of the most common groups (Types II and III) according to surgical measures are presented below.

*Tab 1: Classification of the various types of spondylolisthesis of Neugebauer & Newman, adapted by Wiltse et al.*

<table>
<thead>
<tr>
<th>Type</th>
<th>Description</th>
<th>Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type I</td>
<td>congenital, dysplastic</td>
<td>Type IV</td>
<td>traumatic</td>
</tr>
<tr>
<td>Type II</td>
<td>isthmic</td>
<td>Type V</td>
<td>pathological</td>
</tr>
<tr>
<td>Type III</td>
<td>degenerative</td>
<td>Type VI</td>
<td>postsurgical</td>
</tr>
</tbody>
</table>
Figures 19-21 show the distribution of the spondylolisthesis grades for the three most frequent types. Congenital spondylolisthesis does only show a sufficient sample size in the German speaking group. Error bars are hence large and interpretations must be carefully made. The degenerative form shows more stable estimates and clearer patterns with grade I being the predominant extent of the slip in about 60% of cases followed by grade II in about 20-30%.

**Figure 19: Grade of congenital spondylolisthesis, for the four groups, (surgery form)**

**Figure 20: Grade of degenerative spondylolisthesis, for the four groups, (surgery form)**
The grades of the surgically treated isthmic spondylolistheses show an almost equal distribution between grade I and II with a slight dominance for grade I. All other grades are significantly less frequently represented.

Grade of isthmic spondylolisthesis

![Graph showing grade distribution]

Figure 21: Grade of isthmic spondylolisthesis, for the four groups, (surgery form)

Tab. 2: Classification of spondylolisthesis according to Meyerding:

<table>
<thead>
<tr>
<th>Grade</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grade 0</td>
<td>Lysis of pars without slip</td>
</tr>
<tr>
<td>Grade I</td>
<td>0-25% slip</td>
</tr>
<tr>
<td>Grade II</td>
<td>25-50% slip</td>
</tr>
<tr>
<td>Grade III</td>
<td>50-75% slip</td>
</tr>
<tr>
<td>Grade IV</td>
<td>&gt; 75% slip</td>
</tr>
<tr>
<td>Grade V</td>
<td>spondyloptosis</td>
</tr>
</tbody>
</table>

In the Spine Tango pool 1321 failed surgeries were available for analysis. The different language groups seem to each have a predominant reason for repeat or revision surgeries. While “non-union” dominates in the US group, the “instability” is most frequent in the German speaking group and “neurocompression” in the Scandinavia/Benelux countries. Infections and postural imbalances are the least frequent reasons for reinterventions in all groups.

The percentages add-up to over 100% since this question has a multiple choice format.
Sample sizes of the patient group with inflammation as main pathology are too small for any conclusive observations. It becomes, however, obvious that very few cases with inflammatory spinal or general musculoskeletal diseases undergo a surgical intervention.
The distribution of surgical and general complications is shown without the answer “none”. For surgical complications this answer “none” was most frequent in the US (98.5%), followed by the German speaking group (95.8%) and the “Others” group (93.5%). The highest rate of surgical complications was documented in the Scandinavia and Belenux group (88.7% had no surgical complication). Here the most frequent complication was the duralesion with 7.3%.

**Distribution of surgical complications**

![Graph showing distribution of surgical complications]

Figure 24: Surgical complications for the four groups, excluded was the answer “none” (surgery form)
Complication reporting is the weakest point of any data collection without written adherence to a code of conduct or monitoring mechanisms. These concepts will soon be introduced and offered to the Spine Tango community. Moreover, the different dura lesion rates are most probably explained by strict or less strict interpretations of a dura lesion. Anything from a superficial dural lesion, to a tear, up to a leakage or a revision procedure for a leakage can be deemed a “dura lesion” that is worth being recorded. The Spine Tango dictionary of terms proposes definitions for all items and helps to harmonize the understanding, interpretation and capture of such events.

**Figure 25: General complications for the four groups, excluded was answer “none” (surgery form)**

![Distribution of general complications](image)

Also, for general complications Scandinavia and Belenlux had the highest rate (92.8% answers “none”). In the German speaking-, the “Others”- and the US group similar patterns of general complications occurred (about 97-98% each). Reporting discipline and case mix must be carefully considered when interpreting these figures.
The distribution of followup intervals (figure 26) shows a time dependent decrease of documented followups for all groups, most distinct in the US group with 61.5% of all followups being recorded at 6 weeks and only 0.1% at 1 year after surgery. The most frequent long term followups are documented in Scandinavia and Benelux with 23.4% after 6 months and 16.1% at 1 year postoperative.

On the next page the overall outcome from the surgeon’s point of view is shown across the followup intervals <3 months, 6 months and 1 year. The 3 and 6 month followup groups show decent sample sizes and allow the conclusion that the majority of outcomes are rated as excellent or good in the eyes of the surgeons.
Figure 27: Overall outcome (surgeon) for all four groups at a followup < 3 months (followup form)

Figure 28: Overall outcome (surgeon) for all four groups at a followup of 6 months (followup form)

Figure 29: Overall outcome (surgeon) for all four groups at a followup of 1 year (followup form)
Figures 30-32 show the achievement of the surgical goal "pain relief" according to followup interval. In accordance with the very positive surgeon based outcome ratings, the "Others" group has the highest percentage of achievement in all followup intervals. For the German speaking, the Scandinavia and Benelux and the US group the percentage of achievement of pain relief slightly decreases with time. The 1 year patient sample in the US group is too small for any conclusion.
The functional improvement is quite equally distributed. Except for the German speaking group, the achievement reaches around 60% in all followups. In the German speaking group the achievement of functional improvement is slightly lower, but the fraction of partially achieved functional improvement is larger compared with the other groups. Because of the low case number the US and “Others” group are not interpretable at the 1 year followup.
Different details related to main pathology (surgery form)

Figure 37: Surgical goal: neurological improvement for all four groups at a followup of 6 months (followup form)

Distributions of rates of achievement, partial achievement and non-achievement of neurological improvement were similar to pain relief and functional improvement.

Figure 36: Surgical goal: neurological improvement for all four groups at a followup <3 months (followup form)

Figure 37: Surgical goal: neurological improvement for all four groups at a followup of 6 months (followup form)
German speaking (N= 355)  
Scandinavia and Benelux (N= 22)  
USA (N= 2)  
Others (N= 39)

Figure 38: Surgical goal: neurological improvement for all four groups at a followup of 1 year (followup form)
On the following pages we show an exemplary analysis based on the Spine Tango data pool. To display the possibilities of data analysis we defined three patient groups based on the etiology of spondylolisthesis and analysed different surgical procedures for the patients groups benchmarked within the four country-groups which were used before.

The patient groups were mainly defined based on diagnosis. We focused on isthmic and degenerative spondylolisthesis as the most frequent types of spondylolisthesis. In addition we generated a third group - degenerative disease with spondylolisthesis as spinal comorbidity. To construct more homogeneous groups the inclusion criteria for all patients were a single segment lumbar or lumbosacral surgery.

Mining data from the surgery forms 2005 and 2006 we found 2096 patients with the following distribution across groups:

- Group 1: main pathology - isthmic spondylolisthesis, N= 453
- Group 2: main pathology - degenerative spondylolisthesis, N= 713
- Group 3: main pathology - degenerative disease with additional pathology spondylolisthesis, N= 930

By comparing these groups we have to consider that we do not have information if the spinal comorbidity spondylolisthesis was exactly located at the level of surgery.
To compare demographic data among the patients, age and sex distribution for each country group are plotted. The German speaking group shows a slightly skewed distribution towards the older age groups and has a relatively higher percentage of female patients than the other country groups.
Different details related to main pathology
(surgery form)

Distribution of age by gender (at surgery)
US group, N= 186

Distribution of age by gender (at surgery)
"Others" group, N= 154

Figure 41: Distribution of age by gender in the US group (N= 186)

Figure 42: Distribution of age by gender in the “Others” group (N= 154)
We defined 5 types of surgical procedures:

- Posterolateral fusion with rigid stabilization (pedicle screws and rod)
- 360° Fusion: Posterolateral Lumbar Interbody Fusion (PLIF), with pedicle screws and rod
- 360° Fusion: Transforaminal Lumbar Interbody Fusion (TLIF), with pedicle screws and rod
- Anterior Lumbar Interbody Fusion (ALIF) with or without posterior stabilization
- Decompression only (without fusion or rigid stabilization)

All non-matching procedures are combined in a sixth group as "other surgical procedure".

For more details figure 43 shows all inclusion and exclusion criteria we applied.

The definitions of the surgical procedures were specified based on the surgery form. It became obvious that the current terminology used in Spine Tano does not always guarantee an exact "construction" of a specific surgical procedure. These insights helped us in refining terminology and definitions for the new surgery forms 2011.
Figures 44-46 show the distribution of the surgical procedures for the three main pathologies (isthmic and degenerative spondylolisthesis, and degenerative disease with spondylolisthesis as spinal comorbidity). Differences between the country groups in surgical approaches for similar diseases (all single level surgeries, same types of spondylolistheses within groups) become apparent. For example for the isthmic spondylolisthesis and degenerative diseases with additional spondylolisthesis the Scandinavia and Benelux group most often performed a posterolateral fusion. For degenerative spondylolisthesis the German speaking group mainly applied a TLIF procedure whereas in Scandanavia and Benelux TLIF and PLIF were most frequently performed. In the US, ALIF was quite frequently performed compared with the other groups which did not perform any ALIF for this pathology. The US sample was, however rather small.
Figure 45: Distribution of surgical procedures for patients with degenerative spondylolisthesis (N= 713), for all four groups

Figure 46: Distribution of surgical procedures for patients with degenerative disease and additional spondylolisthesis (N= 930), for all four groups
PARTICIPANTS/ MODULE ANALYSIS

Figure 47 displays the cumulative growth curves of the various national modules. The different starting dates of the modules need to be considered (Swiss/International 2005, Austria 2005; Germany 2006; North America 2007; Brazil/South America 2008; Italy 2008; Mexico 2008; Great Britain 2010; Australia 2010).

The Australian and British modules are both not available via www.eurospine.org because of national data privacy regulations, but the contact persons for these modules are displayed on the Spine Tango web page.

Figure 48 shows an overview of the Spine Tango participating hospitals and their country of origin until the end of 2010. We divided their total case load into primary forms and followup forms.

Compared to the previous year the following countries showed an increase in their participant numbers: Australia (2 centers), Belgium (4 centers), Finnland (2 centers), Germany (16 centers), Italy (3 centers), Poland (1 center), Switzerland (11 centers), UK (2 centers).

Growth rates of the various Spine Tango modules

Figure 47: Growth curves (number of cases of the single Spine Tango modules over the years)
Figure 48: Overview of the Spine Tango participating hospitals according to their country of origin with case load divided into primary forms and followup forms until the end of 2010.
The model of the MEMdoc and MEMdoc-Module system is designed around the principle of data separation. The MEMdoc central server, housed at the MEM Research Center (MEMcenter) in Bern, hosts the main application and the central database containing all study definitions and clinical study data. Satellite MEMdoc-Module servers located throughout the world store all personal data about users, institutions and patients. At the core of the system is an innovative and patent-pending architecture in which the web browser of the client is used as a hub to seamlessly segregate and integrate the data between the MEMdoc-Module and the MEMdoc central server. This design provides tightly integrated communication between the servers while increasing the security and privacy of both systems. This has been accomplished using a lightweight JSON server and incorporation of SSL encryption on each module. Flexible data sharing options have been designed to restrict or expand data access to suit individual needs. Finally, data consistency is controlled through systematic validation of received data and a rollback in case of errors.

Each module server contains a local MySQL database, an Apache web server and the custom MEMdoc-Module application. This server can sit within the same clinic as the user or in some remote location depending on the needs of the group hosting the module. The physical and network security of this server is left up to the hosting entity. Some groups choose to restrict access to the module to users within the local subnet while others allow open access from anywhere. The module database contains all user and clinic information as well as the basic demographic data of patients. No medical data is stored on the module server.
All users from every MEMdoc-Module make their initial connection to the MEMdoc central server that houses the core MEMdoc application as well as all clinical study definitions. The MEMdoc application then recognizes the URL of the connection to determine which MEMdoc-Module to utilize and delivers the appropriate custom module application to the user’s web browser. Each time a user requests data the application contacts both the local MEMdoc-Module and MEMdoc central database (Oracle) to seamlessly integrate the data from each for display. Newly entered data is likewise split so that only internal numeric identifiers for the user, patient, clinic, department and module are stored on the MEMdoc central database. All medical data is retrieved from and stored directly to the MEMdoc central server and linked to the module by these internal identifiers. Medical data never passes through the MEMdoc-Module server and is never stored on the MEMdoc-Module server. The birth year and gender of each patient are the only pieces of personal information stored on the MEMdoc central database for performing pooled statistics.

The physical and network security of all the MEMdoc servers is maintained by IEFM (Institute for Evaluative Research in Medicine) at the MEM Research Center. This includes the MEMdoc central (web) server, the MEMdoc database server and the MEMdoc statistics (SAS) server. All servers are physically housed at the MEMcenter in a dedicated, locked, climate controlled and monitored server room. The network is protected by a Sonicwall NSA 3500 firewall with real-time gateway anti-virus, anti-spyware, anti-spam and intrusion prevention. The firewall only allows access to the servers from the outside via port 443. Additional access is restricted to connections from within the MEMcenter. Web security is controlled by a DigiCert certified SSL web server certificate with 256-bit encryption on the MEMdoc central server and on each satellite module. Each server is continuously monitored to log all connections and to detect any suspicious activity. Additionally, any modules that are hosted at the MEMcenter fall within the same security parameters.

The following hardware is recommended for a MEMdoc-Module:

- Midrange Tower- or 19” Rack server
- CPU Intel Quad Core, Xeon or AMD Opteron
- RAM > 2 GB
- Hardware RAID 1 or 5
- Linux (Debian 5)
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Table 3: Available questionnaires in the SSE Spine Tango registry (01.01.2011)
PUBLICATIONS

PAPERS IN PEER REVIEWED JOURNALS

Kessler TJ *, Melloh M *, Zweig T, Aghayev E, Röder C.
Development of a documentation instrument for the conservative treatment of spinal disorders in the international spine registry Spine Tango.
* contributed equally

Porchet F, Lattig F, Grob D, Kleinstueck FS, Jeszenszky D, Paus C, O’Riordan D, Mannion AF.
Comparison of patient and surgeon ratings of outcome 12 months after spine surgery: presented at the 2009 Joint Spine Section Meeting.

ABSTRACTS IN PEER-REVIEWED JOURNALS

Melloh M, Staub L, Aghayev E, Barz T, Theis J, Roeder C.
Co-variates of length of hospital stay in posterior spinal fusion.
JBJS Br Proceedings. 2010 May;92-B: 345.

Melloh M, Aghayev E, Zweig T, Barz T, Theis JC.
Predictive factors of physician-based outcomes after posterior lumbar fusion.

Melloh M, Roeder C, Zweig T, Barz T, Theis JC.
Benchmarking in spinal surgery – an analysis from the international spine registry Spine Tango.

Zweig T, Aebi M, Aghayev E, Melloh M, Röder C, Sobottke R, Staub L.
evaluative comparison of patient based versus physician based outcome in posterior lumbar fusion – an analysis based on the ‘Spine Tango’ registry.

Zweig T, Aebi M, Aghayev E, Domanja S, Melloh M, Röder C, Staub L.
Predictors of dural tears in posterior spinal fusion in the lumbar spine – an analysis based on data of Spine Tango.
ORAL PRESENTATIONS

April 2010
Melloh M, Zweig T, Aghayev E, Röder C, Theis JC.
Evaluative comparison of physician-determined vs. patient-determined outcomes in posterior lumbar fusion.
Spine Society of Australia Annual Scientific Meeting, Christchurch, 9th – 11th April 2010

Melloh M, Kessler JT, Zweig T, Aghayev E, Theis JC, Röder C.
Development of a documentation instrument for the conservative treatment of spinal disorders within the framework of an international spine registry.
Spine Society of Australia Annual Scientific Meeting, Christchurch, 9th – 11th April 2010

Comparison of patient and surgeon ratings of pain and function 12 months after spinal surgery for degenerative disorders.
International Society for the Study of the Lumbar Spine, Auckland, New Zealand, 14th-17th April 2010

Kleinstueck F, Fekete T, Jeszenszky D, Mannion AF, Grob D, Lattig F, Mutter U and Porchet F.
The outcome of discectomy for lumbar herniated disc is influenced by the level of concomitant pre-operative low back pain.
International Society for the Study of the Lumbar Spine, Auckland, New Zealand, 14th-17th April 2010

Lattig F, Fekete T, Grob D, Jeszenszky D, Kleinstueck F, Mutter U, Porchet F and Mannion AF.
Does the fusion level influence the outcome of single-level posterior lumbar fusion for degenerative disease?
International Society for the Study of the Lumbar Spine, Auckland, New Zealand, 14th-17th April 2010

Does smoking habit influence the outcome of lumbar discectomy?
International Society for the Study of the Lumbar Spine, Auckland, New Zealand, 14th-17th April 2010

Mannion AF, Fekete T, Lattig F, Porchet F, Kleinstueck F, Jeszenszky D and Grob D.
Patient-rated outcomes of fusion in the older patient with degenerative disc disease.
International Society for the Study of the Lumbar Spine, Auckland, New Zealand, 14th-17th April 2010

Porchet F, Lattig F, Grob D, Kleinstueck F, Jeszenszky D, Paus C, O’Riordan D and Mannion AF.
Comparison of patient and surgeon ratings of global outcome 12 months after spinal surgery.
International Society for the Study of the Lumbar Spine, Auckland, New Zealand, 14th-17th April 2010
Röder C.
Spine Tango, proposal for a collaboration with SAS
SAS board meeting, New Orleans
26th April 2010 (invited lecture)

Röder C.
The European spine registry Spine Tango
National symposium for quality management and health care system, Bern
29th April 2010 (invited lecture)

May 2010
Mannion A, Aghayev E, Mutter U, Grob D
Validity and responsiveness of the Core Outcome Measures Index (COMI) in patients with neck pain undergoing cervical disc arthroplasty.
Cervical Spine Research Society Meeting on Corfu, Greece
Abstraktenbuch: S. 45

Zweig T
How to Tango – more than an instruction.
Annual Congress of VSOU (Vereinigung Süddeutscher Orthopäden und Unfallchirurgen e.V.), Baden-Baden, Germany
2nd May 2010 (invited lecture)

Grob D, Luca A and Mannion AF.
Decompression for multisegmental spondylotic stenosis of the cervical spine: anterior or posterior approach?
Cervical Spine Research Society (European Section), Corfu, Greece,
26th-29th May 2010

June 2010
R. Sobottke, E. Aghayev, C. Röder, P. Eysel, S. Delank, T. Zweig
Risk for surgical, general and follow-up complications in lumbar spinal stenosis relative to patient age.
11th Congress EFFORT (European Federation of National Associations of Orthopaedics and Traumatology), Madrid, Spain
2nd-5th June 2010 (podium presentation)

Kleinstueck FS, Fekete T, Jeszenszky D, Mannion AF, Grob D, Lattig F, Mutter U, Porchet F.
Influence of low back pain on the outcome of discectomy for lumbar herniated disc.
Swiss Society of Orthopaedics, St Gallen, Switzerland,
30th June -2nd July 2010

September 2010
Kleinstueck FS, Fekete T, Jeszenszky D, Grob D, Porchet F, Lattig F, Mutter U, Mannion AF.
To fuse or not to fuse in lumbar degenerative spondylolisthesis: do baseline symptoms help provide the answer?
Eurospine, the Spine Society of Europe, Vienna, Austria,
15th-17th September 2010
Lattig F, Grob D, Kleinstueck F, Fekete T, Porchet F, Mannion AF.
Lumbar facet joint effusion on MRI: a sign of instability in degenerative spondylolisthesis? Eurospine, the Spine Society of Europe, Vienna, Austria, 15th-17th September 2010

Lattig F, Fekete T, Grob D, Mannion AF.
Lumbar facet joint effusion sign on MRI in degenerative spondylolisthesis: should it influence the treatment decision?
Eurospine, the Spine Society of Europe, Vienna, Austria, 15th-17th September 2010

POSTER PRESENTATIONS

March 2010
Zweig T, Aghayev E, Melloh M, Aebi M, Röder C.
Comparison of physician-based vs. patient-based outcome after posterior lumbar fusion.
9th – 13th March 2010

April 2010
Melloh M, Staub L, Aghayev E, Theis JC, Röder C.
Predictive factors of physician-based outcome after posterior lumbar fusion.
3. Orthopädisch-Unfallchirurgisches Symposium, Schwedt/Oder.
21st April 2010

May 2010
Aghayev E, Röder C, Zweig T, Melloh M, Kessler J.
Development of a documentation instrument for the conservative treatment of spinal disorders in the international spine registry Spine Tango.

November 2010
Melloh M, Kessler JT, Zweig T, Aghayev E, Theis JC, Röder C.
Development of a documentation instrument for the conservative treatment of spinal disorders and low back pain within the framework of an international spine registry.
7th Interdisciplinary World Congress on Low Back & Pelvic Pain, Los Angeles, USA
Christoph Röder, MD PhD MPH
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