

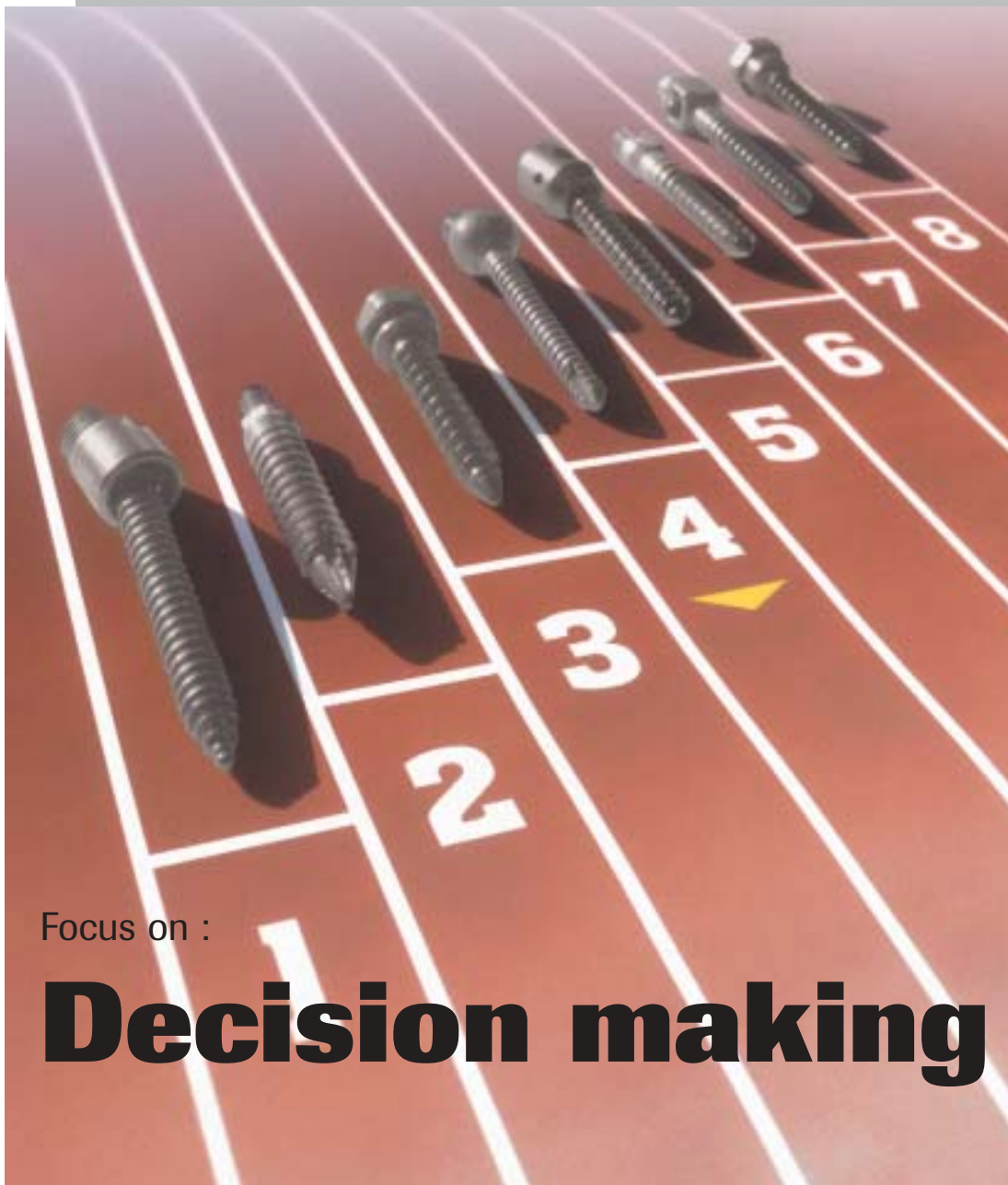
# ARGOS

## INTERNATIONAL

# SpineNews

News from the world of Spinal surgery and Biomechanics

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Focus on :

# Decision making

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Pitfalls in spinal metastasis

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Boston, Massachusetts USA

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Bern SWITZERLAND

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a European project for the design of a web based tool for preoperative planning



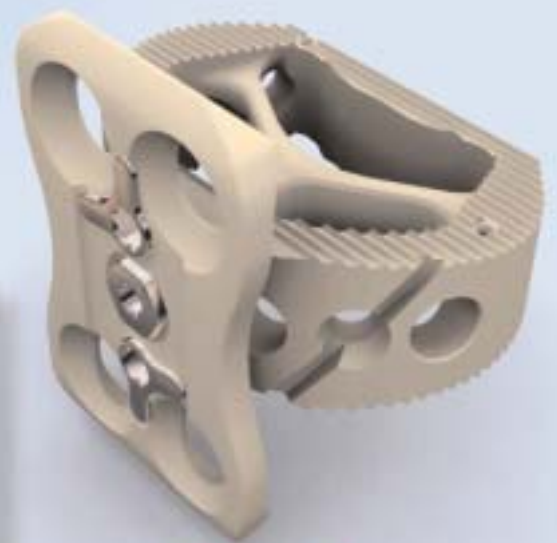
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# ARGOS

## *SpineNews*

News from the world of **Spinal surgery and biomechanics**

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*Conceptual illustration on the theme :  
"Decision making in spine surgery"*



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The choices facing the spinal surgeon have never been more difficult and controversial. As technical and technological advances continue to accelerate, the costs of intervention continue to escalate. As research costs rise, industry continues to increase its direct-to-patient and direct-to-surgeon marketing. At the same time, national health care systems, increasingly strained by changing tax bases, aging populations, and popular expectations, strive to restrain the ever-growing cost of providing care.

**I**T IS INTUITIVE that surgery is technology dependent and that technology is expensive. Thus the paradox arises, to provide the most current or the most responsible care ? In this darkened arena the modern spinal surgeon practices her art. And in the corner of the field, flickers the lighted concept of “evidence-based medicine”.

On the surface, it is all so simple. Compile statistics, weigh the costs and the results in large groups, and then apply the lessons derived from those investigations. But do the lessons of populations always apply to individuals ? From time before memory healers have tailored their treatments to the person before them, not the general mass of

humanity. And yet, our societies can no longer afford the concept of “everything for everyone”. Hard choices are necessary and, if spinal surgeons stand by passively, then others will make those choices – others less experienced, others who are not sworn to protect the patients. As a specialty, we must engage deeply in this debate, or we have failed ourselves, and our oaths.

To begin the discussion – and hopefully throw some light into the arena – Argos SpineNews interviewed leading surgeons from around the world. The opinions may surprise you... ●

– **William Blake Rodgers, MD**  
*Associate Editor*

Argos SpineNews is published twice a year by SurgiView SAS. Printed by ICL Lens France. It is sent for free to physicians, surgeons, researchers and industrial companies on an international scale. Single copy price is 7€.

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# The 9th international **Argos** symposium

Paris, January 27-28, 2005

“Pitfalls in spinal metastases” was the topic of this year’s Argos International Symposium, held in Paris, January 27-28. This topic is still a matter of debate all over the world and over 250 attendees gathered at the Salons d’Iéna eager to exchange their ideas and different points of view in the well-established friendly and collegial atmosphere of Argos meetings. The faculty this year was particularly brilliant. The speakers covered most of the issues related to spinal tumors in general and more specifically spinal metastases and their management.

**P**ROFESSOR Alan M. Levine, MD, from the Sinai Hospital of Baltimore, MD, USA, opened the first session with a tremendously interesting lecture on the use of the Cyberknife, a new technology dedicated to radiosurgery, successfully used in spinal tumors management (see also Argos SpineNews #10, October 2004). With regard to other similar techniques, such as the Gamma Knife, the CyberKnife presents several advantages, i.e. real time localisation of the tumor, better multidirectional focalisation of the beam, half a dose at the skin level when compared to GammaKnife, high accuracy of the beam target and better protection of the spinal cord.



> Professor Alan M. Levine

However, the indication is restricted to isolated tumors and therefore should not be used for multiple successive levels. This technique may also be combined with previous surgery when needed. As a conclusion, Dr Levine emphasized the ambulatory aspect of this new treatment. Indeed, the duration of the treatment and recovery is particularly short and a third of patients treated with the CyberKnife avoid further surgery. Nevertheless, the multidisciplinary approach, i.e. surgeon and oncologist, is paramount for a successful treatment of tumors with CyberKnife, as well as with any other techniques.

## Session 1

“Total Vertebroectomy : When ?” was the topic debated by Dr Juan Antonio Martin Benlloch, MD, from Hospital Universitario “Dr Pesset”, Valencia SPAIN, and by Professor Stefano Boriani, MD, from Ospedale Maggiore, Bologna ITALY.

In Dr Martin’s opinion, this highly controversial technique should only be used when the life expectancy can be increased and neurological relief achieved. Once again, the multi-



> Doctor Juan Antonio Martin Benlloch

disciplinary approach is important, as the physical condition of the patient must be taken into account before deciding for such a radical surgery. To do so, Dr Martin recommends the use of several clinical scoring systems, i.e. Karnofski, Tomita, Tokuashi.

**In conclusion,** one must keep in mind that this technique is meant to decrease pain and reduce the risk of local recurrence and thereby is best adapted for isolated tumors. Patient selection is critical and must take into account all available clinical criteria.

Professor Boriani, former pupil of Roy Camille and Campanacci, has extensive experience in the treatment of spinal tumors. His experience led him to develop an algorithm for the management of spinal tumors (see Argos SpineNews #10, October 2004). Total vertebrectomy should allow for a total excision of the tumor. To do so, a large excision is recommended. In a series of 118 total vertebrectomies he performed, the post-operative survival rate was between 12 and 144 months. 78 patients lived more than 24 months after surgery. 32 patients had only one recurrence. When en bloc resection is performed, survival rate is identical to intra-tumoral excision, except for renal cell metastases when the survival rate is higher after total en bloc resection than after intra-lesional excision and radiotherapy.

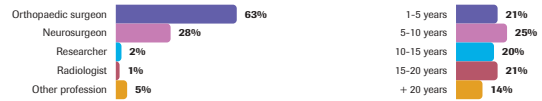
**In conclusion,** the early results are identical with palliative resection or en bloc resection in terms of pain relief and stabilisation. However, survival rate may be higher after en bloc resection, depending on tumor histology.

**The round table discussion** that followed these presentations featured Professor Vincent Pointillart, MD, from Hôpital Tripode, Bordeaux FRANCE, Professor Christian Mazel, MD, from Institut Mutualiste Montsouris, Paris FRANCE, John G. Heller, MD, from Emory Orthopaedics & Spine center, Atlanta, GA USA, Professor Katsuro Tomita, MD, from Kanazawa University School of Medicine JAPAN, Professor Alan M. Levine, Professor Stefano Boriani and Dr Juan Antonio Martin Benlloch.

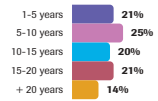
## Buzzers vote result

### General :

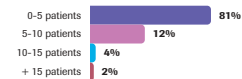
You are :



Since how many years have you dealt with bone metastases ?

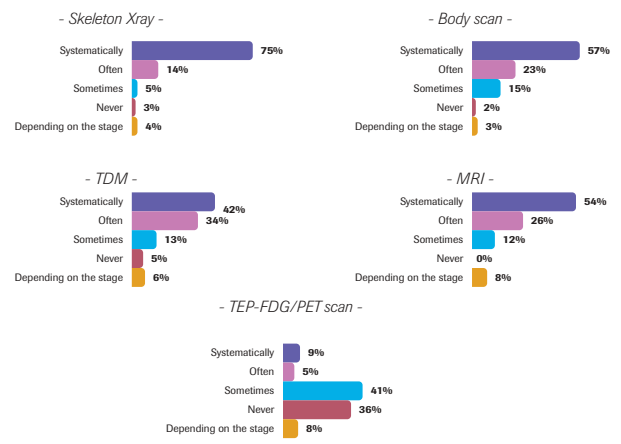


How many patients with bone metastases do you treat per month ?



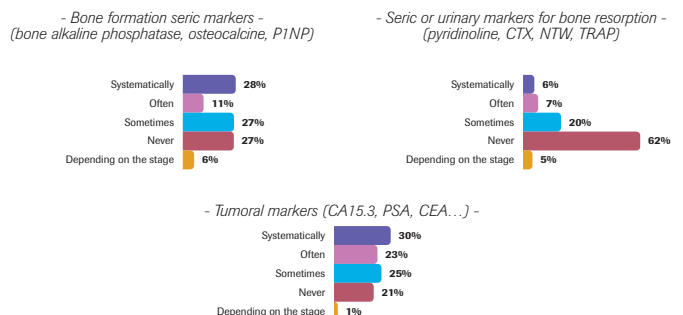
### Diagnosis :

During the initial examination, of a patient with bone pain and a known primary cancer often associated with bone metastases, how often do you recommend the following exams :

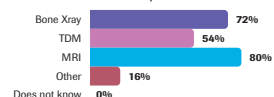


### Diagnosis and follow-up :

During the initial examination, when dealing with primary tumors often associated with bone metastases, how often do you recommend the following exams ?



When the body scan is positive with a patient suffering from spinal pain, having a cancer medical history, to assess the diagnosis of metastasis, do you recommend the following examinations : (multiple answers)





> (left to right) Stefano Boriani, John Heller, Antonio Martin

The first question came from Pr Pointillart who wanted to know how to avoid disseminating tumour when performing an en bloc resection.

Pr Boriani answered that although this risk is always present, it had never been clearly estimated. Dr Martin added that the patient selection is crucial in order to avoid such risks. Alan Levine considers that a higher attention should be paid to secondary treatments and suggested that embolization before total vertebrectomy might be helpful. However, Dr Martin said he prefers not to perform embolization as it might increase the peri-tumoral vascularization. John Heller raised the question of grafts in spinal tumors management by vertebroplasty. To this, Pr Boriani answered that no graft is necessary if additional radiotherapy is needed. On the contrary, Dr Martin uses autologous grafts after discussion of the post-operative delay with the radiotherapist.

Pr Mazel went on to another delicate question : what to do in case of a breast cancer with an isolated spinal metastasis ?

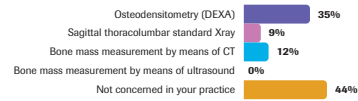
Stefano Boriani answered that the en bloc resection is justified if no radiotherapy is performed. Pr Pointillart added that he would rather discuss the case with the radiotherapist and make sure that there is no risk of fracture. If there is no risk, then radiotherapy will be preferred. If there is a risk of fracture, then he would perform vertebroplasty as the risk of paraplegia associated with fracture is terrible for the patient. Pr Tomita considers that the en bloc resection should not be used in cases of visceral metastases. As for other indications, Pr Levine suggests melanoma metastases.

**To close the discussion,** Dr Heller reminds the assembly that a lot of information is required in order to take the right decision. It is paramount that the surgeon resist the temptation of performing an en bloc resection just for the sake of the technique. The patient must come first in this decision making process.

## Buzzers vote result

### Non-surgical treatment :

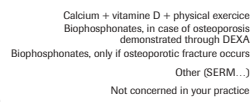
Bone loss due to anti tumoral treatment. Which investigation means do you use in order to quantify bone loss ?



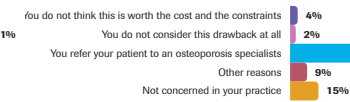
When dealing with a 40 year old woman patient suffering from breast cancer, do you try to prevent bone loss due to chemotherapy related menopause ?



If yes, how ?

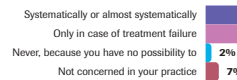


If not, why ?

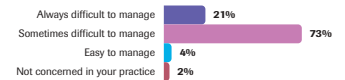


### Pain management :

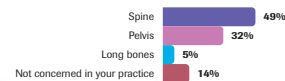
Do you refer to a pain specialist when dealing with bone metastases ?



According to your experience regarding pain due to bone metastases, it is :

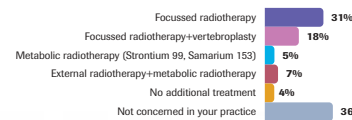


According to your experience, which is the most "rebellious" bone metastasis location in term of reaction to pain killers ?



### Metabolic radiotherapy :

In case of a painful spinal metastasis due to prostate cancer, without any sign of cord compression associated to several body scan hyperfixation sites within the skeleton, what treatment would you suggest, apart from hormonal treatment and analgesics ?



### Radiotherapy :

Now let us focus on the case of a long bone metastasis that might result into a fracture. If radiotherapy is indicated, do you also perform an orthopaedic treatment ?



## Session 2

“What is the best strategy for patients with multiple metastases?” was the topic of the second session, discussed by Stefano Boriani and Vincent Pointillart.

Pr Stefano Boriani reminded the audience that there is no consensus yet for the management of multiple spine metastases and a score and protocol still need to be clearly defined. The lack of consensus, in his opinion, comes from the variability of individuals. The addition of different parameters does not necessarily fully describe the patient condition. Once again, it is paramount to take into account the overall condition and the histological tumour type for correct treatment. The surgical options for the management of multiple metastases are : 1) palliation by decompression and stabilization ; 2) curettage and stabilization ; 3) marginal excision ; 4) en bloc resection. As mentioned earlier, Professor Boriani has developed a decision making algorithm based on several criteria :

- surgical accessibility
- neurological deficit
- ability to recover
- sensitivity to hormonal therapy and radiotherapy
- fracture risk
- life expectancy...

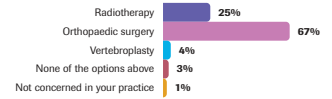
Afterwards, Pr Pointillart outlined the purpose and the limitations of the surgery in multimetastatic patients. The major drawback is that the surgery is not meant to cure the patient but to relieve pain and, only in some cases, to increase the survival rate. One must always give priority to the most urgent problem, such as neurological deficit, for example. Therefore, in some cases it is better to perform the “urgent” surgery first and then do the rest later. As for total vertebroplasty, it should be performed only if the cost in terms of survival rate, additional pain convalescence etc. is not too expensive. Pr Pointillart emphasized the lack of scoring systems for life expectancy in patients suffering from cancer. This kind of scores would be most helpful in cases where the surgeon has serious doubts about the usefulness of surgery. Further on, the nutritional aspect should be taken into



In case of a fracture requiring orthopaedic treatment, do you recommend post-operative radiotherapy ?

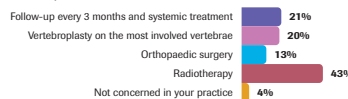


In case of a unique cervical metastasis, with osteolysis corresponding to 3/4 of the vertebral body and 1 pedicle, without neurological deficit. What would you do ?

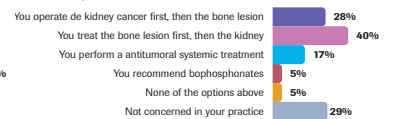


### Treatment strategy :

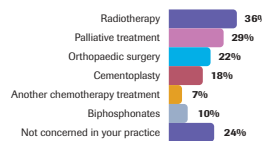
In case of asymptomatic multiple thoracolumbar metastases, with osteolysis corresponding to more than half the vertebral body (on MRI images). What strategy would you adopt ?



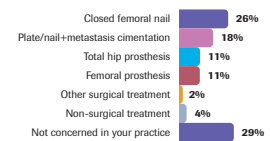
CLINICAL CASE 1 : a 51 year old patient suffers from kidney cancer with an aligc lytic metastasis involving 2/3 of the femoral dyaphisis cortical bone. The extension exam shows no other metastases. What strategy would you adopt after having consulted a multidisciplinary team ? (multiple answers)



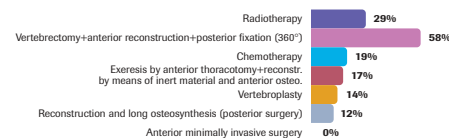
CLINICAL CASE 2 : a 72 year old men suffers from lung cancer with small cells, a suprarenal metastasis and hepatic metastases. He has already underwent a complete chemotherapy treatment. He also has a hyperaligc acetabulum (cotyloid cavity) metastasis that obliges him to lay in bed. His general condition is relatively well preserved. Apart from an optimal analgesis treatment, what do you suggest, regarding the bone metastasis, after discussion with a multidisciplinary team ?



When dealing with breast cancer, for osteolytic bone metastases of the superior third of the femur with fracture risk, what orthopaedic treatment do you suggest, if no polymetastases disease was detected ?



CLINICAL CASE 3 : a 52 year old woman in good overall condition suffers from incapacitating back pain related to a unique metastatis lesion at T10 of a malign melanoma. Medical imaging shows : vertebral body



compression without angulation, osteolysis of the posterior vertebral wall with tumoral bulging in the anterior part of the spinal canal. There is no neurological deficit. What would you do ? (multiple answers)

account, as well as the psychological condition of the patient. In other words, the surgeon must look at the global picture, discuss with the patient and not follow so called patterns as there is no strict rule in these particular cases.

A free-flowing discussion started with a question from Franck Ganem, MD, neurosurgeon from Caen FRANCE : *Why not perform neurological decompression alone in these patients ?*

Vincent Pointillart replied that decompression alone is possible only if the bone quality is still good enough to avoid later collapse. This is usually the case in prostate cancer. Conversely, Stefano Boriani is totally against laminectomy alone, arguing that this procedure will not resect the whole tumor. Pr Jean Paul Steib, MD, from Hôpitaux Universitaires de Strasbourg FRANCE, and Pr Levine consider that laminectomy alone, without stabilization, will lead to spinal instability.

Another question came from Pr Mazel, who wanted to know whether one should perform a complete body scan in order to detect all metastases outside spine. Pr Levine answered that body scan is certainly useful, as metastases are systemic diseases, but if there is no pain, so they are difficult to treat. Vincent Pointillart supported this point of view, adding that one should consider only the painful level/region. However, said Stefano Boriani, a pain in the leg could be due to a spinal metastasis or to a bone metastasis in the leg. Therefore, the physicians should systematically check all type of pain in patients with cancer.

**Finally**, all additional tests should be employed for an as early a diagnostic as possible, concluded Vincent Pointillart.

## Session 3

### “How to treat metastatic recurrent tumours?”

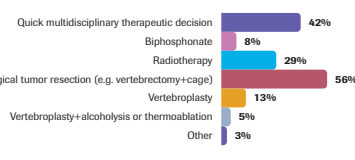
Dr Juan Antonio Martin Benlloch discussed his strategy, i.e. surgery – radiotherapy – chemotherapy, and presented several cases of recurrent spinal metastases to illustrate his approach. In his opinion, it is very important to have systematic MRI follow-up of all patients with spinal metastases and to perform a complete check up of the general condition of the patient. Once the recurrence observed, the surgeon should change his surgical approach and keep in mind pain control.

Following Dr Martin, Dr John G. Heller, presented his approach of these patients, reminding once again the most important principles to respect : 1) risk/benefit balance ratio ; 2) accurate evaluation of the patient’s quality of life ; 3) humanitarian aspects, such as psychological condition, patient’s and family’s wishes ; 4) multidisciplinary approach, even more important than for the initial surgery as the patient is more fragile ; 5) finally the general condition of the patient,

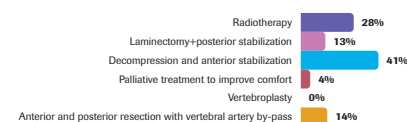
## Buzzers vote result

### Treatment strategy

CLINICAL CASE 4 : A 60 year old woman in good overall condition, treated a year ago by nephrectomy for a kidney tumor of 5cm, comes to the emergency with lumbar acute pain. The examination shows an extended lytic lesion at L1 without neurological deficit nor neuro radicular compression. There is no local kidney tumor recurrence. Apart from analgesic treatment, what treatment would you recommend ? (multiple answers )



CLINICAL CASE 5 : What treatment strategy would you adopt when confronted to a female patient in good general condition presenting with cervical metastases associated with a cervicobrachialgia for which MRI images show a radiculo-medullar compression ? Pre-operative arteriography also demonstrates a unilateral predominant vertebral artery surrounded by tumoral tissue.



the surgeon’s experience and the access to technology are also important factors to take into account. In other words, one should always try to cure pain and instability and evaluate the pros and cons for a second surgery. In any event, the treatment should not be more painful than the disease itself. One should not forget that a patient with recurrent metastases usually presents immunity deficits. Furthermore, if radiotherapy was performed prior to surgery, then the risk of wound complications is higher.

As Dr Martin had already stated it, Dr Heller emphasized the importance of adapting the surgical approach for the second surgery. When the initial surgery consisted in an anterior resection, then the second surgery should be a posterior one with second stabilization, whereas in case of initial posterior decompression and stabilization the scenario is less encouraging. Indeed, the surgeon should perform an anterior reconstruction first and then a posterior restabilization is often required. Later on, Dr Heller presented several clinical cases in order to illustrate his strategy.

**To conclude**, Dr Heller reminded that the ultimate goal of such surgeries is not to cure the patient, but to relieve pain, to restore functional autonomy and to improve the quality of life.

**The discussion that followed this session focussed on the problem of scarring complications in irradiated patients and on the use of cement and/or grafts as well as on the multidisciplinary approach and on the psychological aspects around recurrent metastases.**



> Doctor John Heller

All discussants agreed on the importance of not operating directly onto the irradiated skin. Alan Levine reminded that the Cyberknife could be used in certain cases. On the other hand, new radiotherapy devices are designed to reduce the drawbacks of this technique and skin burns are less and less severe, said Christian Mazel. Regarding the use of cement and grafts, John Heller highly recommend their use if the life expectancy is rather short. Stefano Boriani agrees, but questioned whether the use of empty cages would not be enough as most of the cages are empty when removed. Christian Mazel is more concerned with the risk of cement migration into the canal, while Juan Martin Benlloch prefers the use of grafts instead of cement and usually augments an anterior reconstruction with posterior fixation.

As for the multidisciplinary approach, questions from the floor showed that this is not always easy to organize. Nevertheless, the invited guests outlined the way each of them organizes multidisciplinary staff meetings in his department in order to deal with these particularly difficult cases. One important issue to be considered is the difference between patients who are referred directly to the spine surgeon and those who have already undergone radiotherapy, added Stefano Boriani. Christian Mazel raised the psychological questions around the recurrence : How to deal with poor prognostic indications ? John Heller pointed out that if the patient comes back to the surgeon it means that at least he trusts him, which is already a good start. Then the decision depends on how severe the recurrence is. Dr Martin suggested that easy, quick, and not too complicated interventions were best.

However, what should the surgeon say to the patient ?, asked Pr Mazel. The surgeon should be honest and say that he will try to do his best without giving unrealistic hope to the patient, in Dr Martin's opinion. Dr Heller suggested that the surgeon be as honest as possible with the family but not to tell to much to the patient himself as most of the times the family does not want the patient to be conscious of his real condition. All these considerations depend on how well the surgeon knows the patient and family.

Christian Mazel raised another important factor related to the surgeon's psychology. The surgeon should not feel responsible for the recurrence, as this is not a failure of the initial surgery but a normal evolution of the disease.

## Session 4

**The topic of the forth session – “When not to operate metastatic patients?” - was probably the most difficult.**

Pr Vincent Pointillart explained that in front of these patients, the surgeon has to face his own death or that of his family members, even his children. Hence the difficulty to deal with such situations. He also pointed out the importance of the decision not to operate when a medical treatment exists. In other words one should operate only those patients who cannot benefit from other treatments, as surgery is not necessarily the best solution especially for patients in the final stage. However, the final stage is not always easy to identify.

**In conclusion,** deep reflection and good questions are paramount in the decision making process in such situations. Although the answers might be blurry or even wrong, the one who asks himself the right questions will be at peace with his decisions. Again and again, the risk/benefit ratio in terms of quality of life should be paramount. Last but not least, the surgeon should discuss his doubts with the patient and try to walk in his shoes before making the final decision.

Dr John G Heller agreed with Pr Pointillart in most of his statements regarding the psychological aspects, both for the patient and the surgeon. Once again, he insisted on the fact that the surgery should not create additional problems for the patient, but relieve his pain, if possible. Also, when considering the life expectancy as a decisive criterion, one should better define what a good life expectancy means : 3 months ? 2 years ? More ? Finally, said Dr Heller, the national health care policy of each country will also play a major role in the decision making process depending on the budget



> Over 280 participants attended the meeting

allocated for the management of such cases. In the end, it is more difficult to decide not to operate than to operate. Often this decision is based more on feelings than on rational reasoning. Dr Heller closed his speech with an ad-hoc interactive discussion of four clinical cases he prepared for the audience in order to better illustrate the difficulty of this decision.

**The last session** was closed by Professor Katsuro Tomita, who gave a lecture on "En bloc" corpectomy in metastatic patients. The technique has been previously described by Stenner and Roy Camille who popularized it for the treatment of isolated spinal tumors.



> Professor Katsuro Tomita

After having illustrated the technique by means of didactic movies, Pr Tomita presented the complications that may be associated with en bloc corpectomy, i.e. paralysis, excessive bleeding, spinal cord injury, cancer cell dissemination, spinal instability. Spinal cord injuries are the most severe complications. The major cause of spinal injury in en bloc corpectomy is spinal cord stretching. Therefore a very careful manipulation of the spinal cord is essential for the success of this surgery. Also, in order to limit the risk of excessive or brutal elongation, the posterior instrumentation should be inserted before the extraction of the vertebral bloc.

Professor Tomita then presented the main steps of this highly complicated procedure :

- in situ osteosynthesis
- vertebrectomy
- spacer insertion (spacer height must be identical to the vertebral one)
- compression of the spacer (20% shortening will instantaneously spinal cord vascularization and limit risks of ischemia)

The symposium was closed by a synthesis of the four sessions presented by Professor Pierre Kehr, Centre de Traumatologie et Orthopaedie, Illkirch FRANCE, followed by a free oral communications session. Part of this session was organized by the members of Argos North America who presented four papers at this symposium.

A vote for the best oral presentation and for the best poster presentation was also organized at the end of the session. ●

Pierre Kehr, Christian Mazel, Anca Mitulescu <

## Best oral communication award

– Norio Kawahara

Kanazawa university hospital  
Dept of orthopaedic surgery JAPAN

Norio Kawahara was the recipient of the best oral communication award for his presentation on "Total en bloc spondylectomy for solitary spinal metastasis of renal cell carcinoma".



## Best poster presentation award

– Taiji Kondo

Toritsu Komagome Byoin Seiki  
Tokyo JAPAN

After a tight vote, the poster presentation award went to Taiji Kondo for his poster on "Intraoperative radiotherapy for spinal cord compression due to spinal metastasis".



# Thank you all !

“Thank you all for your presence and rich input during the 9th International Argos Symposium. We look forward to welcoming you again next year.”

Argos Board <



Download all pictures taken during this event.  
(See page 41)



## At lunch...

Friday 28th, 2005 - 12:30

A few on-the-spot moments' relaxation before discovering the sumptuous cold buffet in the “Salons d'Iéna”.



## Coktail and visit of the posters...

Thursday 27th, 2005 - 17:30

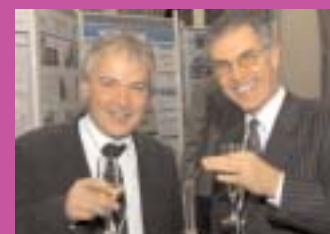
Visit of posters and friendly talks among colleagues.

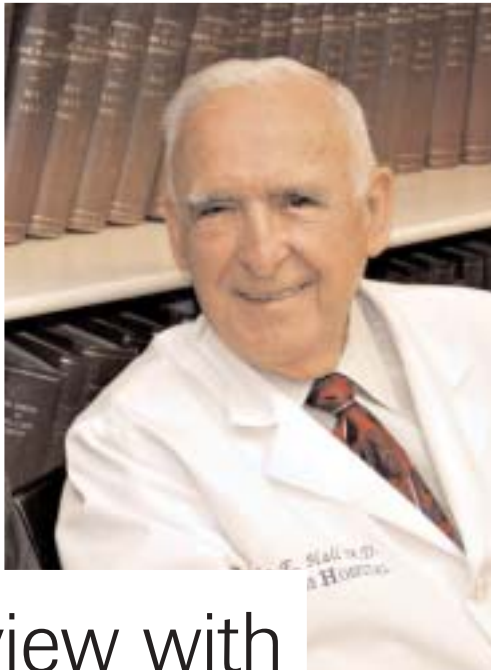


## The key for a successful farewell dinner:

Magic and Champagne !

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## Interview with John E. Hall, MD

### ASN : How did you become a spine surgeon ?

— As a matter of fact somebody else made that decision for me. After training in England I decided I would never do spines. Then when I got on the staff for sick children in Toronto I was assigned to scoliosis by my chief, Dr Robert Salter. So this was not my decision, it was somebody else's.

### ASN : And before becoming a spine surgeon, how did you become a surgeon ?

— It all begun when I was in Bombay, India, at the end of World War II where I've been a pilot in the RAF. I was in hospital recovering from malaria when someone came around from the advisory department and asked me what I wanted to do after the war. I said I thought I would like to be a surgeon. He said "Oh, that's great, a lot of people go to medical school but I do not know anybody who goes to the surgical school". Well, neither one of us knew what we were talking about, but eventually after I got through medical school I decided to do surgery. I started in Toronto for the first couple of years then went over to England where I did most of my orthopaedic training and then finished up back in Toronto again, before going on in the staff of Children's Hospital where I worked for thirteen years, working with Robert Salter most of the time. Then in 1971 I was invited to go to Boston.

### ASN : So your main focus of interest was spine deformity.

— Yes, mainly deformity surgery of the spine. I decided earlier that I did not like looking after people with low back pain and never pursued it at all. But spinal deformity is not all

of my work, I do general paediatric orthopaedics : hip, clubfeet, all kinds of congenital anomalies because when you are teaching students and residents about paediatric orthopaedics you really have to do it too.

### ASN : Could you give us your general view about the history of scoliosis treatment from your personal experience ? The people you met, the various techniques along the years...

— When I trained over in England we used turnbuckle jackets. We used to put people in them and progressively correct the cast as much as we could. After correction they were operated on and spent a year in the hospital, most of them lying down in the cast. When I came back to Canada we used somewhat similar techniques. Then Paul Harrington gave his talk at the academy in 1959 and I went down to visit him and started to do Harrington instrumentation in 1960. Then some modifications kept coming, Luqué with his wire system, much more stable than the Harrington's, then there were all sorts of additions. A significant change came with Cotrel-Dubousset instrumentation. In 1982 I was a visiting professor at Hôpital Trousseau in Paris and heard about people putting a lot of metal in the back, at Cochin and St Vincent de Paul, so the next year I went back and spent time with them and then invited Cotrel and Dubousset in Boston to operate. That was in 1984. For some years after I used the CD system. There were many modifications based on the main principle of the Cotrel-Dubousset system. This principle remained very important as far as I am concerned. More recently there were a lot of modifications with less of rotation and more lateral translation. Pedicle screws added further stability and a better control of rotation so it's been a continuous process of change ever since I started and I presume it will continue.

### ASN : One of your major fields of activity is congenital scoliosis. Could you give us an overview of what congenital scoliosis is and what the available treatments are ?

— Congenital scoliosis is different from idiopathic scoliosis, in that, although it is not genetic, the children are born with deformed vertebrae and since the deformity starts at such an early age it can be extremely severe even after a few years of growth. It has always interested me to try to handle it at the earliest possible time. Since bracing has absolutely no effect on congenital scoliosis we have to talk about surgical treatment, which consists mainly of approaches both of the front and the back of the spine because there are problems on both sides. It was Arthur Hodgson in Hong Kong that first showed me how to do hemi-vertebrae resections and operations like that. As I was working in a children's hospital we tend to get that type of case, so the major part of my practice has been dealing with congenital scoliosis, although I've done idiopathic scoliosis as well. But my major preoccupation has been congenital scoliosis and how to deal with it at an early stage.

**ASN : How do patients treated for congenital scoliosis grow and develop ? Do they have a normal life ? Do they grow in a harmonious way afterwards or do they have lifelong problems ?**

— They are often born with many problems. Congenital scoliosis may not be their only problem, because at the time when the spine is developing a lot of other things are developing. So abnormality may be present in other systems like the heart, the abdominal contents, and so on. The “easy” ones are those that have what’s called the hemivertebra, which is a failure of a half of a vertebra to develop. This can be handled rather early in life by taking out the abnormal vertebra. Full correction can then be obtained at one level and from then on the spine will develop normally. But in other cases, when you have a failure in a spinal segment and you have what we call a bar, that inhibits growth so the spine is always short, so the capacity of the lungs is small. The way we used to treat it was by doing a fusion early on to stop its progression. This kept the spine where it was but led to a progressive loss of pulmonary function, which was a problem in later life. So, in the last few years Dr Campbell from San Antonio, Texas, has developed a system that he calls a “prosthetic rib”. The device is an expandable rod attached to ribs, which increases the capacity and increases the length of the spine rather than decreasing them and that brings a lot of hope for the future.

My interest in hemivertebra led me to develop a system where the patient is treated by operation in the first few years of life, lying on the side. The front and back are opened at the same time and you can often get total correction of the curve of the spine, caused by the hemivertebra at one level, with a fusion so that the spine will get normal length and normal mobility. That’s where it stands at the moment.

**ASN : Harvard is one of the biggest medical research centers in the US. As a professor in Harvard medical school, could you please tell us what Harvard medical school is and how you work there.**

— My professorship is at the Children’s Hospital in Boston and I can tell you more about that than the others. As you know Professor Mankin, who was also attending the Argos North America meeting this year has been in charge of the Massachusetts general hospital for most of the time that I’ve been there. He has a very large

research unit, which is devoted to studies of bone morphology and chemistry and topics like that. At the Children’s Hospital the emphasis in the past has been on biochemistry under Dr Glimcher but more recently it branched into biomechanics under Brian Snyder and into epidemiology under Dr Kocher. In the other labs around Boston, biomaterials, biomechanics, various types of prostheses and things of that order have been very important. Recently at the Children’s Hospital and at other hospitals in the area there have been a lot of studies of genetic abnormalities and this is, of course, a very important topic now. When you are dealing with congenital anomalies in children and types of problems that develop with growth and lend themselves to enzymes or genetic manipulations. It’s a field in its infancy and no one knows where it will finish. It is one of the major occupations in many areas of Boston right now.

**ASN : Did you feel that the cooperation between medical doctors and engineers was more intense in Boston area than in other places where you’ve been ?**

— Well, that’s hard to say because everything is evolving with time. In Toronto I worked largely with engineers for the development of prostheses because I was in charge of the amputee clinics in Ontario. We had a research center where there was a lot of developmental work on prosthetic engineering. In other areas there is good cooperation with engineers as well. In Boston of course it evolved like everywhere else, but with MIT there the cooperation with engineers has been fostered by the Harvard MIT program. A certain number of medical doctors get their medical degree at Harvard also get a PhD from MIT and of course that led to much cooperation between engineering and medicine. In our particular unit engineering and biomechanics have become very important recently. I think that cooperation between engineering and medicine, orthopaedics more

## About...

### John E. Hall, MD

*Boston, Massachusetts USA*

John E. Hall, MD, Professor of Orthopaedic Surgery at Harvard Medical School and Orthopedic Surgeon-in-Chief, Emeritus, at Children’s Hospital, Boston, is one of the most influential and original thinkers in the field of deformity surgery in the last half century. Dr Hall’s professional history dates from his work with Salter in the 1950’s up through



his continued and evolving commitment to improving surgical treatment of children with spinal disease. He is a founding member, as well as past president, of the Scoliosis Research Society, and has been active in the Pediatric Orthopedic Society of North America. His publications and appointments are far too numerous to list but they bespeak a life dedicated to the care of the suffering child. ●

particularly, is nationwide, but I can only speak for what's happening in Boston.

**ASN : The evolution of technology contributes to higher costs of medicine. Could you give us your point of view on this issue and on the way we can treat more and more people with decreasing resources and such expensive technology ?**

— Well it is a double-edged sword because the technology allows us to do things we could never do before, do them better, get patients out of the hospital faster and have them recover faster but on the other side it's become much more expensive. This is something we are going to be forced to pay more attention to. For instance, you can get an almost perfect correction of a thoracic scoliosis by putting pedicle screws at every level. So if you do a ten level, two screws a level, at \$850/screw, it is very expensive before you count on the operating time and everything else. The hospitals are now beginning to take a closer look at it and what I think is going to happen is what happened in Canada, where the hospital has to decide on a certain set of technical equipment for, let's say scoliosis. At the moment, we can pick and choose. We can order anything we want and we expect the hospital to cover it in their budget, but I think that's not going to continue. What can happen is that we'll have to decide on maybe one or two sets of equipment and then go on with that. And when you have a choice between something that is terribly expensive and something that isn't, we may start to get pressured to take the cost into account, particularly in a hospital like ours. The tendency in our country because of rising costs is to have plans for treating certain conditions and it is going to become more and more necessary to adhere to plans rather than utilize innovative techniques. I think this is going to be a double problem. You will be forced to use the equipment that is readily available in the hospital and also to use a system that is not too expensive. All the political bodies point to some type of regulated healthcare. I do not think it will be a full national system, because it is very difficult for any country to afford to give everything to everybody, but it will be some kind of system, which is more regulated than we have at the moment. This will contain costs better than it will encourage innovation and expanded technical support. I do not know what the outcome is going to be, but I think in the next few years we are going to see a lot of changes in the way medicine is regulated in the United States.

**ASN : Thank you very much for this interesting contribution. Just some last few words : you came to the Argos NA meeting for the first time this year. Could you give to the Argos Spine News readers an opinion on what you found at Nemaocolin together with the other Argos members ?**

— I really enjoyed it. I was intrigued when Dr Rodgers, who is a very good friend of mine, invited me to the meeting because I didn't know what Argos was up to that point and he

explained it to me. It seems to me to be an excellent idea in view of the way technology is progressing, particularly in spine surgery. Also because of the confluence of neurosurgery and orthopaedics, which are really becoming closer over the time, developing into a specialty of spinal surgery rather than orthopaedics or neurosurgery. The format of the program also encourages that kind of discussion. So I think it is a very interesting development, it does something that most meetings that are steered into a particular line do not actually do. I think it is something that is to be encouraged and I am happy to know of its existence and I look forward to attending future meetings.

**ASN : Thank you very much, Professor Hall. We would be very honoured to welcome you again to our future meetings.**

Interview by Alexandre TEMPLIER <





## Interview with Max Aebi, MD

**ASN : Professor Aebi, you worked at McGill University, Montréal, Canada, and you are now working at the University of Bern, Switzerland, in a new Center for Orthopaedic Research. Can you explain to us how you made this change, what were the main events that led you to this major change in your career ?**

— During my ten years experience at McGill where I was in charge of the Department of Orthopaedics, I followed an advanced program in Business Administration at INSEAD, in Paris-Fontainebleau. This was apparently recognized by the Maurice E. Muller Foundation which approached me and asked me to come to Bern. So I came to Bern to try to understand what could be the future of this Foundation and of the institutions founded by this foundation. So I took a sabbatical in 2000, as this is the rule at McGill, every seven years you are allowed to take one year off if you are a full professor. I decided to go during my sabbatical to Bern at least in the first half of the year to start the reorganization of the Foundation's different institutes. During this time I specifically concentrated on the Institute of Documentation and Continuing Education which has been founded by Maurice E. Muller, and I realized that this institute could not survive in the form it was at that moment and I proposed to the Foundation to change the institute completely, and to try

to basically integrate the Maurice E. Muller Institute of Biomechanics and this Institute for Documentation in a common center and to bring them together into the University and to make them a completely independent University institution. Finally, after quite a long battle with the government, the University and the Foundation, we could convince everybody that we should form the so called Institute for Evaluative Research in Orthopaedic Surgery. This name was inspired by the Dartmouth Institute, a very famous institute in this research field in the USA. Then we took a part of the ME. Muller Institute of Biomechanics and formed out of it the so called Institute for Advanced Technologies in Orthopaedic Surgery. These two institutes have finally been merged in the vast field of orthopaedic research, with divisions that cover all orthopaedic research, from bench research, meaning basic research, to the bed side, that means applied research, and beyond, that means outcome research. The center started its activities in January 2003 and covers basically this whole spectrum of research and was moved in an own building which is completely dedicated to this research, and completely refurbished. After all this work and commitment I could not leave this new center and just go back to McGill. So this explains how I came to Bern.

**ASN : You decided to leave a very promising career in Canada for a new life in Switzerland. This must have been a difficult decision.**

— As you know in North America people are not life-time elected on an academic chair. In fact there are re-elections every five years. Most of the people do two terms, that means ten years, which means that if somebody does more than that then this is already quite exceptional. I came here at the end of my second term, after ten years, so I had to make a decision whether I wanted to stay at McGill or whether I wanted to start something new. I had been re-elected for a third term at McGill so, of course it was very difficult to make a decision and to move away. But I thought that there was a real opportunity with this center and what we try to do here and there is something new I can still build. If I wanted to do still something new, I had to do it at this point, otherwise later I would have been too old to do something like that. So there was an opportunity to do something exciting and new. The outcome is still unclear and unknown, I do not know yet

whether I took the right decision, but at least this is something challenging. After ten years doing more or less the same thing I think this is an interesting aspect of my career and that is why I finally decided to come here. The future will show whether this was the right decision to take.

## About...

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Max Aebi graduated the school of medicine in 1975 and earned his private docent (PD=PhD in North America) in 1987 at

the University of Bern. He did his internship in surgery at the hôpital regional de Monastir, Tunisia in 1972, then he continued with an internship in surgery and gynecology and obstetrics at the university of Addis Abeba, medical center, Ethiopia in 1975. From 1976 to 1981, Mr Aebi completed his residency in general surgery at the institute of pathology, university of Bern, Switzerland, then in the department of surgery, at the regional medical center, Langenthal, Switzerland, followed by the department of neurosurgery, Kantonsspital Aarau, Aarau, Switzerland. Finally he was a resident in orthopaedic surgery from 1981 to 1983 in the

### ASN : Could you describe for us the organization of this new institute ? You told us that it was composed of different divisions, how do they work together ?

— We have what we call the MEM center for orthopaedic research of the university of Bern. This center consists of three units. Two of these units are more or less, at least financially, independent institutes. One of them, the institute for advanced technologies in surgery, is led by Professor Lutz-P. Nolte. The other one is the Institute for evaluative research in orthopaedics which I chair. In addition we run a cell biology lab which is jointly run by the two institutes. So this is basically a unit that is directly run by the center organization. Lutz Nolte and myself are co-directors of the center so we basically take all the decisions concerning the whole center together and we also have some common financial obligations for the center. However, within the two individual institutes, the research is completely independent. That means that all the groups within the institutes have their own network with different projects and cooperations and so on. The big advantage of this center is that suddenly we have now clinicians working closely, side to side, with

basic researchers and with researchers who develop new technologies dedicated to orthopaedics. There is a constant exchange of ideas and opinions between these people, so the engineers are no longer developing things which

you cannot use in clinical practice, because they are constantly questioned by the clinicians. In addition, the clinicians also start to understand the process of development and what are the implications when clinicians want to have a certain tool, a certain device or a certain technology. Once the process of development has started the implications are enormous if you want to stop it. So I think that the big advantage of the center is that we have an exciting blend of all kind of researchers, i.e. basic scientists, clinicians, epidemiologists and engineers are working under the same roof, side to side. This gives a climate of some sort of “think tank” for new ideas and innovations in orthopaedic research.

### ASN : Could you give us a vision about the mainstream of research of these three institutes, i.e. the laboratory of biology, the Institute for advanced technologies in surgery and finally for your own institute ?

— The cell biology laboratory has a very close cooperation with the research laboratory of the McGill university, which has two main research directions. One is the research of the regeneration of the disc on a biological level. In this laboratory we are not so involved into the mechanical restitution of the disc by means of a device, but much more in a biological reconstitution of the disc, which means that our research is situated at the level of cell biology and materials for regeneration of the disc. Of course, we are testing different materials for disc repair, nucleoplasty and so on. The second main topic of research is the so called bone augmentation. In this field we are focussing on different technologies to augment the deficient bone in the context of osteoporosis, meaning that we are involved in vertebroplasty, in kyphoplasty, their biological and also biomechanical impact of e.g. vertebroplasty on the biology of the bone. The major area of research of bone augmentation is in spine and to a lower degree in the hip. However the hip related projects are run in a different way than the spinal projects of the institute. Then the Institute for advanced technology in surgery is focussing on imaging technologies in orthopaedics. In relation with that, there is the whole navigation issue but also increasingly the technology to measure in vivo function of the spine without the invasive aspects. Behind this,

there is quite a significant development work in software, either imaging software or navigation software. Obviously, in this institute we also have the classical biomechanics in orthopaedics, but we are increasingly focussing much more on the relationship between mechanics and biology. That means “What mechanical impact has which biological consequences?”. Also if we change biological conditions that means we change e.g. the metabolism of the disc, then what is the impact on the mechanical functioning of the spinal motion segment? This institute has also a complete prototyping workshop for orthopaedic devices and all classical test devices for orthopaedic implants and musculoskeletal functions. Finally we have the third institute which focuses mainly on four areas: one that we have committed to is the musculoskeletal epidemiology, a group lead by Dr Busato, who is an associate professor of epidemiology. In this group there is a section that deals with health technologies assessment (HTA), in close cooperation with the government. Then there is a group that deals with musculoskeletal health, which means they develop measurement tools to measure the outcome in orthopaedics in different age groups, different activities and so on. These groups are all funded by peer-reviewed grant agencies like the Swiss national foundation for scientific research and the government. Then we have a group that is developing software for orthopaedic registries, documentation and for automatic outcome studies. Finally we have the group that is basically exploiting the existing data bank of the former Institute for documentation. We have almost a hundred thousand revision cases in hip surgery, as we have all data sets for patients that had primary total hip replacements. All these data have never been really evaluated and this is a big part of the work of this group resulting in quite a significant number of peer-reviewed publications.

**ASN : What is the global budget of the institute and what is the share between your private partnerships and the public ones ?**

— The university budget is about a third of our money, two thirds of the money come from grants and from partnership with industry. We have a budget which comes close to 8 millions Swiss Francs a year.

**ASN : The activity of the Institute of Evaluative Research in Orthopaedic Surgery which is under your direction seems to be very much oriented towards outcome analysis. Could you explain us the reasons of this main orientation ?**

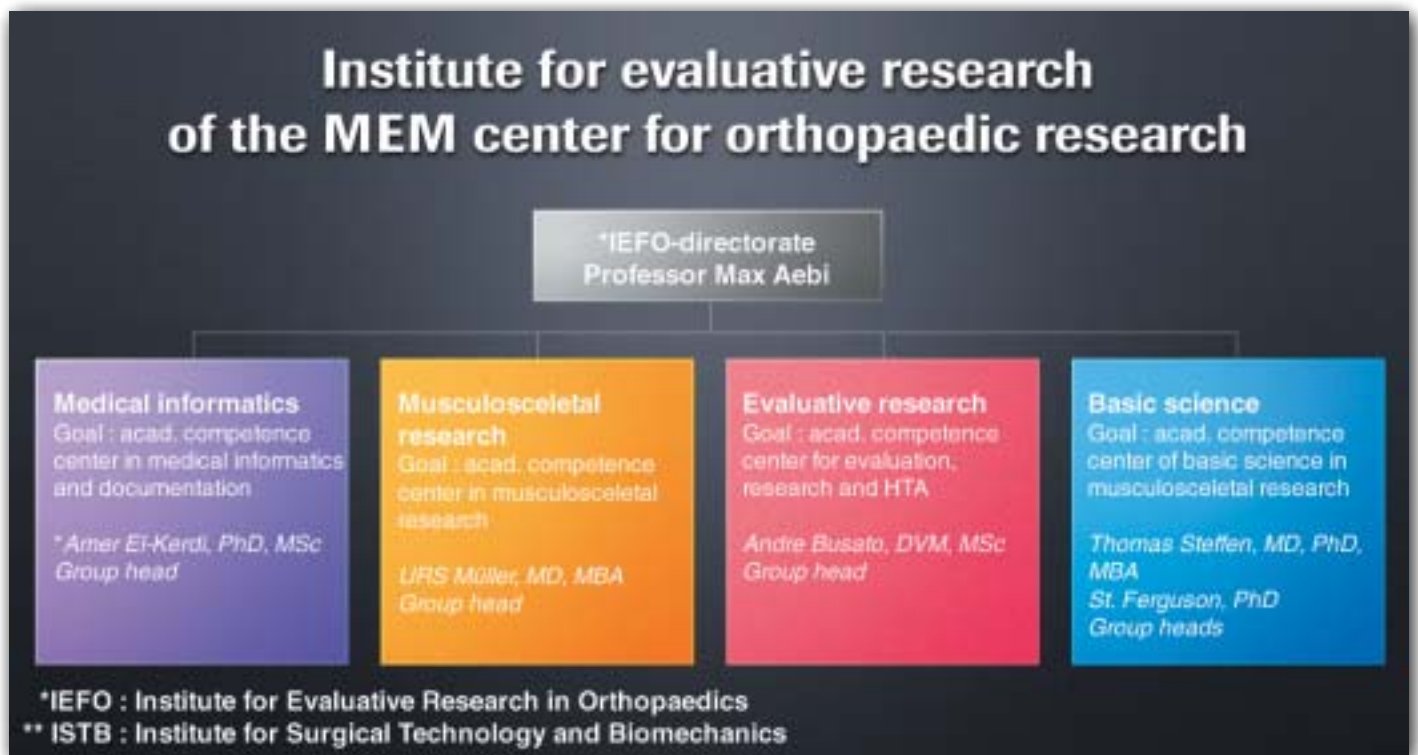
— I think that orthopaedic surgery is a very heavily technology and device driven medicine, which implies that this is obviously very much related to costs – costs of constant new technology introduction. If you want to be up to date you have to adapt to technology. However, very few of these technologies have really proven scientifically to be of a real benefit to the patients. So I think that orthopaedic surgery and more so specific fields in orthopaedic surgery are extremely under scrutinization to come up with proof that what they do in the clinical work is efficient and is really making the outcome of the patient better and is also cost effective. With the general constraints in the healthcare systems around the world this is not just an issue of Switzerland, or an issue of Bern, we have this concern in Canada, we have the same problem in European countries, as the healthcare budgets are all somewhere down in the basement and we do not really know how to get out of it. We have a demography that is developing rapidly to an overaged society which will put a cost burden on the society, as outlined in the Decade of Bone and Joint initiatives. Though even the practicing doctors and surgeons do not see that as a relevant issue in their practice this will be the determining factor in the future for anyone who practices orthopaedic surgery because at some point there will no longer be the funds available to do and to acquire all this new technology that one may think is so beneficial for the patient. I think that everybody

••• department of orthopaedics, university of Basel, Switzerland, doing both adult and pediatric orthopedics.

From 1979 to 1984 he also completed a research program in experimental surgery, university of Basel in conjunction with AO-research institute, Davos, Switzerland on bone transplantation and in parallel with this research program he attended training courses in microsurgery in the department of plastic and reconstructive surgery, Kantonsspital Aarau and department of surgery, university of Basel, Switzerland. In 1999 he graduated INSEAD, Fontainebleau, France, getting the certification AMP (Advanced Management Program).

Max Aebi is the recipient of many prizes and fellowships awarding his academic and clinical research, such as first prize of the German/Austrian/Swiss trauma surgery society for the best scientific presentation; the SICOT/SIROT award (Aebi, Regazzoni, Schwarzenbach); the AO/ASIF recognition award; the Zimmer/COA professorship, Toronto and London, Ontario; the research fellowship, Swiss orthopaedic society (Steffen T, Aebi M);

•••



who started to think about what we do and where that leads in the future has to come to the conclusion that we need tools to measure what we do and to figure out which of the methodologies and devices we use are really efficient for the patient. That is the reason why we have focussed on this research ; we also developed tools to measure the outcomes in individual patients, because an outcome in one patient may not be the same in another patient, depending on the functionality and the need of each patient. So we need tools to measure and we need also tools to compare and one of the most interesting tools, as shown by the Scandinavians, are registries, specifically in device related research. This means that if you want to know if the outcome is better with one device than with another, we have to establish a standardized way to collect data, specifically relevant data, so we need to develop systems which allow us to have quantitative data and to also analyze these data to come to conclusions in the future. This is the reason why we started to develop registries in a new way because the registries that existed before, were used for the last 25 years, and were therefore developed with outdated methods. In our institution we try to change the technology for these registries, the technology to acquire, the technology to evaluate, and the technology to administer data, in order to make it easier and to make it more attractive for surgeons to participate. There is no doubt that surgeons should participate ; there must be an incentive, which can be by the doctor himself, to get invested in his own data and compare other data, or from the insurances or the government.

We think that the best thing to do is to convince surgeons to do it themselves, more than to force them. It has to work like that, there is no doubt, because we have examples with e.g. the disc replacement in Switzerland which has been stopped by the government and the surgeons are no longer allowed to do that and the government is now demanding a registry where all this kind of surgery is documented. I think that the cost of health and the demographic development we are expecting and the expansion of even more costs in the health economy force us to have some systems to measure what is the outcome with certain technologies.

**ASN : You talked about the increasing health care expenses with the new technologies coming in. The fact is that to establish a systematic follow-up of the patients would mean to examine them on a regular basis, which would probably cost more. So this seems a critical decision to be taken by the authorities, which is to spend more now in order to perhaps save money in the future. Do you believe this could be done in major developed countries in the near future ?**

— This is very difficult to predict because of the different attitudes in these countries. For instance, in Germany surgeons are not at all encouraged to follow up their patients because the whole follow-up is done in the network outside the hospital. However, for instance in Switzerland, the surgeon who performs the surgery is encouraged to follow-up

the patients and the follow-up is paid for by the insurance. So I can follow up my patients without restriction as the insurance pays for the follow-up. I think that with the data available, for instance within the hip registry, we can demonstrate that a surgeon can only have reliable results when he is also following-up his patients. There is increasing understanding in the insurances as well as in the government that this is a must. In Switzerland there are different models where the insurances are now approached to pay even a fee for the documentation of the patient's outcome so they give an incentive to the surgeons to follow their patients. This is certainly a very difficult issue, it depends a lot of the healthcare environment and the willingness to spend money for that, but I think that finally – and I hope that one day it would be possible to prove that – it is cheaper to do a systematic and standardized follow-up of the patients than to have just everybody doing surgery without follow-up. It will come to certain things which will not be liked by doctors, for instance somebody who does a certain number of cases per year without follow up, will finally not be allowed to do these cases. We have in Switzerland the situation in which the insurances are forced to make a contract with every doctor that has been certified and approved by the medical society to practise medicine, and they are automatically obliged to pay him. Now the insurances as well as the political party in this country are increasingly questioning surgeons on their data. So what will happen if those surgeons who want to make a surgery will have to show their previous data to the authorities in order to be allowed to perform that surgery ? This is a forced incentive to doctors to document their cases because they will need these data to get the approval to practise.

**ASN : For the same spinal pathology treated with the same treatment, the outcome in some patients may be different related to the saggital balance, for example, or the personal biomechanical parameters. How do you take into account those kinds of measurements in your evaluation ?**

— There is a patient evaluation in these registries consisting of a few parameters that have been tested in many many places, in

different cases. We call that a core dataset. But obviously, in very specific pathologies, such as deformities, there are additional questionnaires available where specific data can be collected to see whether there is a relationship between the outcome and the pain in a given patient, or the saggital and the frontal balance. So, of course, when you want to have more detailed knowledge about a specific pathology, there are subsets of questionnaires that can be used for these specific pathologies. What we are talking about is what costs most of the money in orthopaedic surgery, and this is true for spine surgery in degenerative diseases. About 60% of the whole pathologies are related to low back pain or neck pain. This is a different pathology from deformities. Idiopathic scoliosis or congenital scoliosis are very specific pathologies, where the outcome depends a lot of the surgical performance, of the spine balance, and these patients are not coming in consultation because of low back pain. This is a different pathology, a different age group, so for these groups of patients there are subsets of questionnaires, as there are for spinal tumors and trauma. The trauma issue is a separate issue because the trauma patient is a different patient from the low back patient.

Of course, with a registry you cannot collect data about everything, there is a certain core set, but if you want to know more, then you have subsets that define exactly the pathology and the treatment, so you can see what is the relationship with certain treatments.

**ASN : Thank you very much Pr Aebi for this interview.**

••• CORE/ACORE award of the Canadian orthopaedic association (Antoniou J, Alini M, Poole R, Aebi M) ; the Volvo award in clinical sciences (Boos N, Reider R, Schade V, Spratt KF, Semmer N, Aebi M) ; the McNab/LaRocca fellowship award (ISSLS) (Matyjewski M, Steffen T, Kropt P, Aebi M) ; the CORA/ZIMMER basic research award – 2nd prize (Antoniou J, Alink M, Pike B, Steffen T, Baramki H, Aebi M) ; the 1st Prize – best research paper presentation award of the Quebec orthopaedic association (Antoniou J, Aebi M) ; the Roger Simoneau award ; award of the Quebec scoliosis society (Rubin R, Steffen T, Peters T, Aebi M) ; the 2nd prize – Deutsche Gesellschaft fuer Unfallchirurgie, Posterpreis (Steiner B, Hehli M, Perren S, Aebi M, Steffen T). He is also an honorary and full member/officer of numerous academic and scientific societies worldwide and author of quite an impressive number of scientific publications. He is currently a professor and chairman at the institute for evaluative research in orthopaedic surgery, university of Bern, Switzerland and adjunct professor in the department of surgery, at the faculty of medicine, McGill university, Montreal, Quebec (Canada). He is also the chief of staff at the orthopaedic hospital, Bern, Switzerland. ●

Interview by Alexandre TEMPLIER <

# Agenda

Meetings of interest for spine surgeons and Biomechanics specialists

## Live instructional non-fusion spine course

Instructional live surgery via satellite  
May 3, 2005 - New York, NY USA  
[www.swiss-spine.ch](http://www.swiss-spine.ch)

## Spine arthroplasty summit 5

May 4-7, 2005 - New York, NY USA  
[www.spinearthroplasty.org](http://www.spinearthroplasty.org)

## ISSLS

International society for the study of the lumbar spine  
May 10-14, 2005  
New York, NY USA  
[www.issls.org](http://www.issls.org)

## American spinal injury association

May 12-14, 2005 - Dallas, TX USA  
[www.asia-spinalinjury.org](http://www.asia-spinalinjury.org)

## 21st annual meeting of the CSRS European section

June 16-17, 2005 - Rome ITALY  
[www.ega.it/csrs21](http://www.ega.it/csrs21)

## CAOS

5th annual meeting of the international society for computer assisted orthopaedic surgery  
June 19-22, 2005  
Helsinki FINLAND  
[www.caos-international.org](http://www.caos-international.org)

## International congress of neurosurgery

June 19-24, 2005  
Maraksh MOROCCO  
[www.marrakesh2005.org](http://www.marrakesh2005.org)

## IMAST

12th international meeting on advanced spine techniques  
July 7-9, 2005  
Alberta CANADA  
[www.imastonline.com](http://www.imastonline.com)

## CARS 2005

Computer assisted radiology and surgery  
July 22-25, 2005 - Berlin GERMANY  
[www.cars-int.org](http://www.cars-int.org)

## World Spine III

The third interdisciplinary congress on spine care  
July 31-August 3, 2005  
Rio de Janeiro BRAZIL  
[www.worldspine.org](http://www.worldspine.org)

## ISOST

International society of orthopaedic surgery and traumatology  
September 4-9, 2005  
Istanbul TURKEY  
[www.isost.com](http://www.isost.com)

## EuroSpine 2005

September 21-24, 2005  
Barcelona SPAIN  
[www.eurospine.org](http://www.eurospine.org)

## NASS

20th annual meeting of north American spine society  
September 27-October 1, 2005  
Philadelphia, PA USA  
[www.spine.org](http://www.spine.org)

## SRS

Scoliosis research society 40th annual meeting  
October 26-30, 2005 - Miami, FL USA  
[www.srs.org](http://www.srs.org)

## SOFCOT 2005

Société Française de chirurgie orthopédique et traumatologie  
November 7-11, 2005 - Paris FRANCE  
[www.sofcot.com.fr](http://www.sofcot.com.fr)

## CSRS

Cervical spine research society annual meeting  
December 1-3, 2005 - San Diego, CA USA  
[www.csrs.org](http://www.csrs.org)

## 10th International Argos Symposium

Thoracolumbar fractures. Acute, malunion, vertebroplasty.  
January 26-27, 2005 - Paris FRANCE  
[www.argos-europe.com](http://www.argos-europe.com)



Visit the Congress Web Site for regular updates at [www.ega.it/csrs21](http://www.ega.it/csrs21)



# 21<sup>st</sup> Annual Meeting of the Cervical Spine Research Society European Section

Rome, 16-17 June 2005 | Rome Cavalieri Hilton

## Cervical Spine Deformities and Malalignments

Chairman: C. Logroscino

### Organising Secretariat:

**ega** Professional Congress Organisers  
Viale Tiziano, 19 | 00196 Rome, Italy  
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[csrs21@ega.it](mailto:csrs21@ega.it)



# SpineView, the digital spine analyzer

**Y**ou often perform measurements on your spinal Xrays. These measurements are time consuming, and their reliability is difficult to evaluate. What you need is a fast, accurate and reproducible method.

Discover SpineView, the new generation of goniometers.

With SpineView, a few minutes are enough to click on spinal segments on a digital Xray, and to visualize your measurement results, with a documented precision and

reproducibility. Four modules (Frontal, Sagittal, cervical Dynamic, Lumbar dynamic) calculate a comprehensive set of parameters describing Spinal posture and intervertebral mobility.

➤ Digitizing	3'
➤ Localization of the bone segments	3'
➤ Calculation, visualization, exportation and results analysis	3'
<b>➤ Total time</b>	<b>9'</b>

\* Important notice : SpineView is not a diagnosis tool.

www.surgiview.com



# 10<sup>TH</sup> International Argos Symposium

JANUARY 26-27, 2006 / PARIS FRANCE

## Thoracolumbar Fractures *Acute, Malunion, Vertebroplasty*

**Preliminary program :**

- Thoracolumbar (burst) fractures
- Malunion
- Old patients fractures

**Guest Speakers :**

Jacques CHIRAS, MD	FRANCE
Robert MELCHER, MD	GERMANY
Michel PHILIPPE, MD	FRANCE
Claes OLERUD, MD	SWEDEN
Jean-Paul STEIB, MD	FRANCE
Mark WEIDENBAUM, MD	USA

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Anca MITULESCU, PhD
Alexandre TEMPLIER, PhD



# STUDENT THESIS AWARD

## Rewarding the best thesis in spinal surgery or biomechanics

**The Argos Thesis Award recognizes outstanding medical and/or Biomechanics research targeting a contemporary clinical problem in the management of spinal pathologies. This award is open to all scientists having completed a PhD or PhD candidates at the end of their PhD program as well as to medical students for a Master of Sciences Thesis or for a Medical School Thesis.**

Nominees must not have completed/defended their research work prior to November 2003. A cover letter specifying the candidate's interest in being considered for the Argos Thesis Award, 2 copies of the final manuscript of the thesis (in the original language\*) and 3 copies of a long abstract (in English), i.e. up to 5 pages, clearly presenting the nominee's work and having the nominee as first or sole author should be submitted to the Argos Secretary Office no later than October 1st 2005 (see also Instructions for long abstract presentation).

The award decision will be based on the quality and originality of the research work, its potential impact on the management of spinal diseases, its clear and rigorous presentation.

The awardee is expected to attend the 10th International Argos Symposium in Paris, next January and to deliver a presentation of the work recognized by the award (7' oral presentation + 3' discussion).

The award includes a 1000€ prize, winner's travel and accommodation expenses on the occasion of the 10th International Argos Symposium, publication of the long abstract in the European Journal of Orthopaedic Surgery and Traumatology (EJOST).

### Instructions for long abstract preparation :

To prepare your long abstract please refer to the Instructions to Authors in the European Journal of Orthopaedic Surgery and Traumatology (EJOST). For more information, please visit Springer website [www.springerlink.com](http://www.springerlink.com)

*\*Depending on Argos Board members capacities of reading the original language, i.e. at least one Board member currently reads and speaks your language. For more information, please contact Marjorie Salé : [marjorie@argos-europe.com](mailto:marjorie@argos-europe.com)*

### Call for abstract

Electronic submission deadline October 1, 2005. Submit to : [abstract@argos-europe.com](mailto:abstract@argos-europe.com) or directly on the website : [www.argos-europe.com/abstract.html](http://www.argos-europe.com/abstract.html)

### Submission rules :

- Abstracts must be submitted by September 1st, 2005. All abstracts received after that date will not be considered
- Abstracts must be submitted electronically
- Abstracts must be submitted in English
- Abstract recommended format :
  - Title
  - List of authors associated with the abstract
  - Main headlines : 1) Introduction and purpose, 2) Material and Methods, 3) Results, 4) Discussion and conclusion, 5) References, 6) Acknowledgements
  - Presenting author contact information (phone, fax, eMail address, mailing address)
  - Institutional affiliations
  - Abstracts should not exceed 500 words
- Abstracts are reviewed by the members of the Argos Scientific Committee and will be read in "blind" fashion.
- Argos will send notification of acceptance via eMail to the presenting author on or after November 22, 2005.



## Modern decision making Practical issues in Switzerland

National healthcare systems around the world and private health insurance carriers have undergone major changes recently, most especially in reimbursement. As spine surgery is a field where technological progress provides the practitioner with more and more advanced but also highly expensive tools, it seems that each country is trying to take a position to contain escalating costs. However, from one country to another, decisions may be radically different depending on each country's social security policy. Decision making in this context is more and more dependent on multiple factors that are not necessarily patient related.

**S**WITZERLAND has always been somehow “different from the others” in many fields of activity. Today, tremendous changes both for patients and medical doctors arrive with the Swiss healthcare reform. Doctor Philippe Bédât, MD, active member of the Argos Board and a founding member of Argos, is currently an orthopedic surgeon in Geneva, Switzerland. Mr Bédât kindly accepted to give us a rather broad overview of the current context in his country, related to the new trends in social security policy when confronted with the modern challenges and constraints.

“Reimbursement policy varies from one canton to another, depending on economic criteria”

In Switzerland there is no state-controlled social security system (as in France for example). Health insurance is mandatory for everyone, however each one can freely choose his health insurance office. Insurance subscription fees vary from one health insurance office to another, depending on the company and on the geographic regions. Nevertheless, 10% of the cost of medical care will always be paid by the patient,

whatever insurance he chooses. Everything is controlled by a governing body in which the state and the insurance companies are represented. Patients and doctors do not participate in these negotiations. The lobby of insurance companies is very strong at the political level, because of the increase in health costs. Recently we have seen what can only be called an attempt at takeover by the insurance companies who are willing to control the whole system. According to the law on health insurance (LAMal) any medical benefit must be reimbursed if it is listed in the medical benefits catalog which was set up at the beginning of 2004. Each benefit corresponds to a certain number of points. The point value is calculated according to different economic criteria. It can vary from one canton to another since infrastructure costs and wages are different from one region to another. Currently, insurance companies must reimburse all national health physicians, and patients can freely choose their physician. In the future, this situation may change since the law is likely to be modified so that insurance companies can choose which doctors will be reimbursed. (The ones who are less expensive !) This also means that patients will not be able to choose their physician if they want to be reimbursed by their insurance company. It is obvious that such measures will provoke a rancorous debate within the medical profession and the population.

This only concerns basic benefits, payable by the mandatory insurance, i.e. ambulatory benefits provided in public or private hospitals as well as in doctor's offices. In-patient

hospital stays and the associated treatments are only reimbursed in public hospitals, as a daily lump sum. It is obvious that such a sum does not cover the real operating costs of public establishments. It is at this level that the State intervenes by giving grants to public hospitals. For example, in Geneva, 60% of operating costs in public hospitals are borne by the State, i.e. by the whole population paying taxes.

Private clinics do not receive such grants and people who want to be treated here must have supplementary health insurance which is, of course, not mandatory. This is a private contract between the insured individual and the insurance company; the state does not intervene in any way. Thanks to the supplementary health insurance the patient can freely choose the hospital and the physician he wants. Tariffs in the private sector are obviously different from the public one concerning both the accommodation and technical platform but also physician's fees. Those elements are counterbalanced by the fact that the State subsidizes much of the operating costs of public hospitals. In fact, the patient cost is not cheaper in public hospitals than in private clinics if state subsidies are considered. It may even be the more expensive.

Specifically regarding surgical procedures, the national insurance reimburses the fees on the basis of a daily lump sum. Implants are reimbursed separately. Public hospital surgeons are not paid for their surgery since they are employees of the hospitals. Exceptions are made for those who have the right to work in the private sector of public hospitals (in general, department heads). Supplementary insurances apply only in the private sector and address the costs which are not covered by the mandatory insurance. These costs are essentially linked to the room quality, to the technical platform, and to the surgeons' and anesthetists' fees.

New reforms are expected to enhance the role of family doctors and restrict specialist's decision making power, but paradoxically, in a rather rich country like Switzerland, the quality of health care might decrease drastically in the light of new reforms.

The new healthcare reform states that reimbursement rates for medical doctor's fees should be based on the duration of each patient contact. This is in fact highly restrictive as consultations will be limited to the strict minimum time. It is obvious that the quality of the patient-practitioner dialogue will decrease.

Furthermore, family doctors tend to be treated preferentially by the new system, because the new legislation might soon require that the patient consult his family doctor first, whatever his health problem. Then the family doctor will refer him to the appropriate specialist. In theory, this new rule should limit unnecessary consultations. However, in practice, the specialist will become frustrated since he will not be allowed to order any investigations himself, but will have to refer the patient back to his family doctor with a recommendation for the appropriate tests. This new regulation has not been adopted yet, but health insurance companies are already offering lower subscription fees to those clients who adopt this procedure.

Another drastic measure to regulate health costs comes as a moratorium on private office certification. In practice, this moratorium forbids the certification of new offices until old offices close, which means that a specialist cannot open his private office until another specialist in his area closes his. This regulation is intended to increase public practice, which is supposed to cost less, but will surely not encourage specialization in the future.

## About...

### Philippe Bédât, MD

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*p.bedat@bluewin.ch*



Dr Bédât graduated from the medical school in Geneva in 1974. Afterwards, he worked as an assistant in anatomy from 1975 to 1976.

In 1980 he earned his Swiss federal degree in medicine.

His ten years of post-graduated training in different hospitals in Switzerland included work as an assistant physician in general surgery (hôpital de la Chaux-de-Fonds), in sports medicine and rehabilitation (university hospital in Geneva), in adult and paediatric orthopaedic surgery (university hospital in Geneva – orthopaedics unit), then as a senior registrar in paediatric surgery (clinic of pediatric surgery, Geneva), and in orthopaedic surgery (university hospital in Geneva – unit for bone and joints surgery). ● ● ●

“Insurance companies make continuous pressure for low medical practice fees”

“Most of new technological assets certainly increase quality of health care, but they might become unaffordable in the new context”

... He defended his doctoral thesis and obtained his FMH specialist certification (Swiss federation of physicians) in orthopaedic surgery in 1990.

From 1990 to 1997 he was a consultant physician at the university hospital in Geneva.

Philippe Bédât is one of the founding members of Argos (Association Européenne des Groupes de Recherche pour l'Ostéosynthèse Rachidienne), president of SGCO (Société Genevoise de Chirurgie Orthopédique) since 1999 and an active member of Société Suisse d'Orthopédie.

In 2001 he worked at the hospital of Lokichokio, Kenya, on a surgery mission with the comité international de la Croix-Rouge (Sud-Sudan civil war).

Dr Bédât currently works as an orthopaedic surgeon in private practice in Geneva and as a consultant at the clinique du dos (“back clinic”), hôpital de La Tour à Genève.

He has been involved in humanitarian activities on a regular basis since 1996, serving in a hospital in the northern part of Burkina Faso (Africa) as well as in a health care center of Croix-Rouge in Ouagadougou. ●

To these changes in the whole system one must add the constant pressure from insurance companies, who want to funnel patients to those doctors who have lower fees.

Even though theoretically insurance companies cannot dictate the quality of medical care, medical examiners from insurance companies can ask for information from a patient's attending physician about tests or treatment. In this process, the price of the medical benefit plays a more and more important part (generic drugs, complementary medical examination...).

As for litigation, the number of complaints against physicians is increasing. In addition to complaints through legal actions, patients can enquire at the Swiss physicians federation (FMH) to ask for an extra-judiciary appraisal. The conclusions of such an extra-judiciary appraisal could possibly be useful in a lawsuit. This procedure is free of charge.

So, in practice, insurance companies play a more and more important role in this reimbursement and control policy. The economic reasons for this pressure are obvious and one could easily hypothesize the impact on the quality of health care. In other words, the new regulations meant to limit health care costs

will dramatically lead to discrepancies between rich and poor patients, as rich ones will afford better and quicker care than the others.

Swissmedic (Swiss institute of therapeutic products) and particularly its medical devices division publishes the list of Swiss or foreign companies recognized by Swiss law concerning the quality of products. The CE marked devices are considered as conforming to Swiss law due to their compliance with the 93/42/CEE Directive.

Nowadays computerized tools are more and more present in order to facilitate standardized patient follow-up, billing as well as medical practice evaluation.

Computers are essential for the management of medical activity. By the end of the year 2005, billing should be done by computer in Switzerland. Computers and the Internet are, of course, more and more indispensable to communicate, receive information or images (Xrays for example) as well as to consult the literature. Besides, patients have learned the usefulness of the Internet to get information on the surgeries we suggest or on any other medical subject, even though the information is not always of good quality and is sometimes misunderstood.

Besides, other specific technologies develop rapidly and are today easily accessible to everyone. MRI is the best example. For instance, there are over ten MRI systems in Geneva for only 500.000 inhabitants, which means that practitioners prescribing this test can get the results within 2 or 3 days. On the other hand, patients become more and more demanding and expect to have immediate access to such techniques since they are readily available.

Conversely, the insurance companies would prefer to restrict access to such investigations because they are still rather expensive. Hence

the conflict between cost limitation on one side and technological progress and high standards of living on the other.

## “Collaboration between biomedical industry and medical staff is jeopardized”

The Swiss academy of medical sciences and the Swiss physicians federation have recently adopted a new directive on the rules to regulate collaboration between biomedical industry and medical doctors. This directive is meant to prevent financial abuse and corruption in medical practice. To do so, it drastically limits the fees to be paid by biomedical companies to physicians in exchange for consultancy, such as participation into clinical research projects, clinical trials, workshops on selected products, expert advice and so on. However, the directive makes a clear distinction between private and public practitioners. While the former are not allowed to receive any compensation whatsoever anymore, for the latter it is left to their hospitals to decide the amount and nature of compensation that is considered ethically acceptable.

Obviously such a situation may soon lead to frustration for some and abuse for the others and may destroy the relationship between industry and physicians, instead of efficiently regulating it.

Another area where the total restriction of industrial involvement with practitioners may prove detrimental is in continuing medical education. Since any grant from a company is forbidden to private physicians, only public hospital physicians may be able to afford these expensive conferences. Will this kind of situation result into restructuring part of the private practice? Only time will tell.

In conclusion, decision making in such an environment becomes much more complex a process than expected. Indeed, the surgeon no longer has total freedom to choose the best options for his patients since his decisions are more and more impacted by forces – economic, social, and legal – that were once secondary. The ethical debates arising from these conflicts will continue to burn brightly in Switzerland and around the world. ●

Philippe BÉDAT, MD <  
Anca MITULESCU, PhD <



## A new corporate identity to reflect our worldwide expansion

**Since its creation in 1996, the Argos association had not renewed its image. After an eight-year active existence, the logo of our association does not correspond anymore to current graphic trends and its symbolism lacks strength.**

Today Argos is proud to count over 250 members from more than 70 countries and publishes its 11th Argos SpineNews official journal while preparing its 10th International Symposium. Encouraged by the dynamic growth and quick expansion of our group, we would like to mark these events by presenting our new and more ambitious image.

As any symbol, our logo bears messages. Its silhouette is based on the past but its dynamism, which is resolutely contemporary and uncommon, displays our ambitions. It is proudly carrying complementary colours and reflects its community's cultural diversity.

We are proud of this symbol, in the elaboration of which every member of the executive committee got involved. This democratic elaboration process will certainly be a favourable condition to its adoption by everyone. ●

Karim BOUKARABILA <





## Interview with **Edward C. Benzel, MD**

**ASN : Today we have the privilege of speaking with Prof. Edward Benzel of the Cleveland clinic and we're going to talk about his point of view regarding fusion as a neurosurgeon and, in a bit more detail, also about the controversy regarding fusion in the US. Dr Benzel, could you give us a broad vision of what is the role of fusion in the spine and what are your perceptions of the technical aspects and the main problems that remain to be solved.**

— Well, that's a very broad question. That's sort of like asking me about what's my philosophy of religion. Nevertheless, I feel that fusion surgery is an important aspect of spine care as many have stated before, it is my opinion that we probably do too much fusion surgery in that we should be more selective in our decision making process. There are many approaches to lumbar and cervical fusion and in general, I prefer inter-body fusions if everything else is equal in that fusion seems to be acquired more readily in the inter body region. I utilize spinal instrumentation most often when performing inter-body fusion procedures and usually use instrumentation when performing posterior fusion procedures. Of note however, is that I've done an increasing number of lumbar laminectomies with uninstrumented fusion in order to provide stiffness,

prevent restenosis, and hopefully reduce the incidence of subsequent subluxation and spondylolisthesis. Recent advances in instrumentation and osteobiologics such as involving bone morphogenic proteins are revolutionizing fusion surgery. They vary significantly in their cost and they also vary significantly (evidently) in their efficacy. I believe we need to determine value of each new technology that we apply. Value = quality/cost. If we are willing to spend increased resources and money for a technology, the technology had better be worth it before we continue to spend that money. In that vein a selective use of spinal instrumentation and a selective use of bone morphogenic proteins and related techniques would be wise at this point.

I think we are going to face further problems in the future with regard to the utilization of artificial disc and other most preservation strategies. The actual patient population and whom they may be appropriate may in fact be very small and in addition the cost of the technology is potentially excessive. It is estimated that artificial discs will be costing approximately \$10,000/level in the United States. If that is the case, their utilization must be very selective before we embark on such an endeavor individually and collectively as spine surgeons.

**ASN : Thank you for such a complete answer to this broad question. So in fact it seems that there is a big gap between the advances we can see on the techniques and the implants, on one side and on the decision making and planning tools that are provided, or not provided in fact, to the surgeons. Do you believe in the future of such tools ?**

— Yes, first of all, technology is good – just like knowledge is power – but one can abuse technology. I have often quoted Paul Lynn who stated “Avoid Subservience to High Technology”. I think that high technology is very good, it’s good for patients, etc. However, if we abuse it and use it indiscriminately, we will elevate and escalate the cost of medical care and at some point no longer be able to afford the high technology, so we must as spine surgeons, be responsible.

**ASN : In light of the difficulties that surgeons face selecting the proper patients for intervention, do you think that computer technology may help surgeons to work together in a more accurate and more analytical way and then apply that knowledge to clinical experience for the future ?**

— Yes, I do think the outcome assessment is incredibly important. We need to be able to track our outcomes much more effectively than we are. Currently we’re simply using outcome assessment. We’re really not correlating that with outcome predictors and we need to be looking for variables, clues and data points that can actually tell us who are high risk and who are low risk patients for surgical procedures then perhaps, taking it a step further actually allowing us to determine what clinical strategy may be appropriate for an individual patient. I do believe that with computer technology – improved data base management and acquisition systems – we can achieve that potentially in the next 5 to 10 years.

**ASN : Thank you very much Dr Benzel.**

Interview by Alexandre TEMPLIER <

## About...

**Edward C. Benzel, MD**

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At the Cleveland clinic foundation, Dr Edward Benzel is chairman of the Cleveland clinic spine institute with joint appointments in the departments of neurosurgery and orthopaedic surgery. He is also vice chairman of the department of neurosurgery and program director for the neurosurgery residency training program. In 2001 and 2002 Dr Benzel received the teacher of year award. Previous appointments included Professor and Chief of the division of neurosurgery at the university of New Mexico. While in New Mexico, he trained many neurosurgery residents and research fellows, as well as postgraduate clinical fellows and postgraduate spine research fellows. During this time, Dr Benzel received the award for faculty excellence in post-graduate clinical (resident) teaching. Dr Benzel earned a medical degree at the medical college of Wisconsin, and received the Millman award as the student who best exemplifies the characteristics of an ideal physician. He continued his medical training at the medical college of Wisconsin with an internship and residency in neurosurgery and a fellowship in spine surgery and spinal cord injury. Dr Benzel is an active member and leader within many professional organizations including : American Association of Neurological Surgeons (AANS), Congress of Neurological Surgery (CNS), Cervical Spine Research Society (CSRS), North American Spine Society (NASS), American Syringomyelia Alliance Project (ASAP) and Society of Neurological Surgeons (SNS). Dr Benzel is meeting chair for the World Spine II (WSII) meeting convening in Chicago, Illinois, August 10-13, 2003. The WSII meeting, which is predominantly an initiative of NASS and AANS/CNS joint section on disorders of the spine and peripheral nerve, will directly address the issues of world spine health. Speakers from the world health organization, American medical association, and a variety of Western and third-world countries will provide a much needed insight into world spine health. Dr Benzel has seven US patents in the area of spine surgery. Dr Benzel is on the editorial review board of numerous scientific journals in the field of spine and neurosurgery. A prolific author of scientific research, Dr Benzel has authored six books. In addition to writing full books, he has contributed 109 chapters to medical texts and edited thirteen books. Dr Benzel also writes commentaries, letters and reviews for various professional spine journals. Articles written by Dr Benzel for peer-reviewed journals amount to 127. His research is published in over 272 abstracts. Besides publishing research, Dr Benzel is frequently invited as a visiting professor, speaker and instructor at hospitals, universities and major medical meetings. In 1996, the American academy of neurological and orthopedic surgeons awarded Dr Benzel the lifetime achievement award. ●

# Interview with **Pr. Vincent Arlet, MD**

Charlottesville, Virginia USA



## About...

### **Pr Vincent Arlet, MD**

*Chief Spine Surgery University of  
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Vincent Arlet, MD, graduated the faculty of medicine, Paris university in 1981 and did his internship in Paris hospitals from 1981

to 1986, in general surgery, pediatric surgery and finally orthopedic surgery. In 1985 he earned his doctorate in medicine at the university of Paris with a medical thesis on the treatment of infected tibial non union with intertibiofibular graft. Just after his graduation from medical school, Vincent Arlet spent one year of research fellowship at the Montreal general hospital. His research focused on the posterior cruciate ligament injuries and their functional outcome. From 1987 to 1990 he was a senior registrar and assistant in pediatric and adult orthopedic surgery in several hospitals in Paris

• • •

**ASN : Doctor Arlet, what is your understanding of Evidence Based Medicine and further more of its role within the decision making process in spine surgery versus the individual aspects strictly related to each patient management ?**

— I think that the ultimate goal of medicine is going to be taking decisions according to evidence based medicine for the ultimate benefit of the patient. The problem we have in adolescent idiopathic scoliosis is that we do not have any evidence based medicine so far. So we need to determine the evidence based medicine. For example we have the natural history of idiopathic scoliosis but we do not know what the good treatment of this disease is. If we look at the outcome of the patients in terms of questionnaires of health quality assessment we have a little bit an idea of what the outcome of the surgery is. I think that these questionnaires can give up to 80-90% of the outcome of the surgery. The problem is that this does not mean that the patient is happy with his surgery because pain is not that big an issue in adolescent idiopathic scoliosis. On the contrary in the adult spine, one may judge the result of the surgery on whether the patient has pain or no pain and also on function. In the case of adolescent idiopathic scoliosis, pain after surgery at long term is very moderate or even

inexistent so that's why one cannot judge the outcome on post-operative pain. So the first evaluation of the outcome by means of questionnaires does not necessarily lead you to a good knowledge of the outcome of the surgery, because 80% of the patients are satisfied even though when we look at the Xrays the aspect may look horrible.

The second aspect of this issue is that if we only look at the Xrays of the patient they are going to give us only one third of the picture of the surgery. Trying to judge surgery on the Xrays only will not give us much information about the overall outcome. For example, we had patients with very good Xrays but who have very bad medical results.

Third thing we can look at is the clinical photo of the patient which will allow us to judge on the cosmetic result of the surgery. But, once again, it is not because we have a nice cosmetic result that we necessarily have a good overall outcome of the surgery. We may have done, for instance, a too long or a too short fusion and the cosmetic result is good but we do not know what is going to happen in the long run.

In conclusion, in order to be able to judge the results of the surgery and to have evidence based medicine in adolescent idiopathic scoliosis we need to consider the three aspects mentioned earlier. Questionnaires, Xrays and clinical photos as well as all clinical records have to be stored together in order to enable us to judge a surgery and to create evidence based medicine. Anything less than that will not give us evidence based assessment of adolescent idiopathic scoliosis. And that's where I come with the software I developed.

**ASN : Before discussing the software, I would like you to tell us how you deal with this particular disease in the long run. It is obvious that the expectancies of a young population who has a lifetime ahead are radically different from those of an elderly population. How does evidence based medicine help you with this long term perspective ?**

— Indeed, the exigencies are different. In a young population we will certainly try to relieve pain, when pain is present, to improve the cosmetic aspect and to make sure the function is preserved as much as possible, in order to avoid long term problems. One of the major concerns is revision surgery which might occur in idiopathic scoliosis treatment because of this long term perspective of such surgeries.

**ASN : How about health care policies that tend to restrict the expenses related with medical acts in general and more specifically in the field of spine surgery ? How do you deal with this major issue in a**



## The Scolisoft registry software.

The story behind the software

**The story of the Scolisoft spine registry software started in 1999 with the widespread use of personal computers by the spine community. I therefore asked one of our most proficient resident in the computer science to come up with a program that would store all the information we need to review a surgical case of spinal deformity. Dr Dragos Macelaru who was finishing his residency at McGill and a friend of his Mr Stelian Chirila from the company AAHeat Info, spent a few months on the devising of the software. We started to insert our cases of spinal deformity and very soon helped with Saint-Justine hospital, Hubert Labelle and Marie Beausejour we had a databank that we could access with the click of a mouse on any personal computer.**

The goals of the Scolisoft registry software is multiple purposes

### 1) Decision making for the surgical treatment of a spinal deformity

Imagine yourself in front of a patient for which there is a clear and obvious need of surgical correction. In terms of decision making for the type of surgery you have to do (approach type, levels to be fused, types of anchors in the spine) you can rely on your personal experience that is probably constantly evolving, you can rely on the numerous published papers that are often contradictory from one author to the other and often from one paper to the other paper (written by the same author), or ask different spine surgeons who will very likely all give you different answers. If one can identify a group of exactly identical curves, in terms of curve magnitude, curve flexibility, countercurves, deviation from the midline, or even identify same classification types it is possible to review these curves and judge what the best treatment was for each of these specific curves. Say the patient in front of you has a 65° right thoracic curve Lenke type 1 B and with a lumbar curve of 45°. Curves flexibility are 45 and 30° respectively. The sagittal profile of the patient is normal. Typing these informations in your query window you will instantly view all the cases that correspond to these criteria. You can review the Xrays, the clinical photographs and the postoperative results of all these cases. These cases may be your personal cases or the ones from somebody else. . . .

**context where new technology spreads more and more and where medical acts such as long fusion surgeries are highly expensive ?**

••• (hôpital Necker enfants malades, hôpital de Saint-Germain en Laye, university hospital of St-Antoine). Vincent Arlet is currently associate professor of surgery and director of spinal surgery unit at the university of Virginia. He has an extensive experience in the whole spectrum of spine surgery (pediatric and adult, trauma, tumors, degenerative, cervical and deformities) and has performed over 1200 spine deformities surgeries. Vincent Arlet is the author of numerous peer-reviewed scientific papers and book chapters and has been invited to lecture all around the world. He is also the author of Scolisoft, a software dedicated to evidence based medicine for scoliosis management. Dr Arlet is the recipient of several awards in recognition of his research work in orthopedics and spine surgery. He was appointed president of the Quebec scoliosis society for the 2001 meeting and also as a member of the task force for a spinal surgery curriculum by the scoliosis research society. He is the chairman of the AO spine scoliosis committee in charge of a scoliosis registry and relevant educational materials and active member of numerous societies (scoliosis research society, Canadian orthopaedic association, société Française de chirurgie orthopédique, American college of spine surgery, groupe d'étude en orthopédie pédiatrique, North American Spine Society). ●

— This brings us again to Scolisoft, the software I developed in order to judge the results of the surgery and to help the surgeons in surgery planning. This software can also address the cost concern as well, because it will show that it is not because you put more screws that the patient will do better. The software allows us to compare different strategies in different or similar patients. We can for example look at identical curves and see the difference between more screws and more hooks and the results with different instrumentations. This kind of analysis showed us several cases where there was an over-instrumentation of the spine which led to a bad clinical result. So it is not the more expensive instrumentation we put in the back of the patient that the better results we have. And the software we use helps us prove it.

**ASN : How about prevention ? The costs of systematic screening may seem huge but they are certainly less than the overall costs of surgical treatment. What's your opinion on this issue ?**

— Systematic screening certainly does reduce the number of surgeries. However there are patients that will still need to be operated, in spite of early screening, because of curve progression. This is where the evidence based medicine will play a major role in decision

making in spine surgery, in order to choose the most efficient surgery for a given patient at the lowest expenses.

**ASN : Another question I would like you to address concerns the legal aspects of your profession and the impact of computer technologies on this issues. How does the computer based clinical follow up help you face legal problems when they occur ?**

— Scolisoft, for instance, is very helpful in our experience with unsatisfied patients, because with a click of the mouse you can show the patient how he looked before the surgery. This occurs quite often. A patient will come saying “How come my right shoulder is higher than the left one ?”. In that case, the surgeon will tell him that it is true, that the result is not perfect, but if he takes a look at the pre-operative photos, usually that's the end of the discussion.

**ASN : I suppose you can also use such a software in order to compare your practice to some other practice or even to literature, can't you ? This could be of great help in case of lawsuits for complications due to surgery, for example.**

— Yes, indeed, I can even compare my practice today to my practice ten years ago and see the results of my experience as well as those of others' experience. So, regardless of legal aspects, I think it is very helpful to be able to benchmark your cases against your earlier cases as well as against others' cases. It's kind of a permanent monitoring of my own performances, just like an athlete who, in order to improve his performance, will record a movie of his training just to see better what he could improve and correct what goes wrong. It is exactly the same with the software. You can go back and have a look at what was wrong in your cases and correct yourself. So it is a monitoring of your own practice and therefore a very good quality insurance tool.

**ASN : How do the majority of spine surgeons deal with computer technologies in their practice ? I have no doubt you adopted these technologies long time ago, but how about your colleagues ?**

— In North America, we all had to work with computers long ago, so we had no way to avoid

it. Further more, I get more and more requests from colleagues from all over the US for access to Scolisoft. So I think that computer technologies in spine surgeons' practice is quite a common practice nowadays.

The only problem we have with Scolisoft is to adapt it to a large scale use, so that people could download their cases whenever they want. The next step is the development of this application on the web.

### ASN : Do you have any knowledge about other similar software used for similar purposes ?

— There is a software sponsored by Medtronic and used by the spinal deformity study group of the SRS, but they have a totally different approach than ours. Their approach is based on the numerical and statistical analysis of scoliosis without setting up the guidelines of evidence based medicine. So the software will only give you a mathematical answer, such as the number of screws to put to get a given correction and so on, and that's it. But there is no picture in the software. This is a statistical analysis tool.

Contrarily, the goal of Scolisoft was to help a practicing surgeon who has to deal with a specific case in front of him, who asks himself "What am I going to do tomorrow in the OR ?". He will probably have to take a look to identical cases in his own practice or in the literature or in someone else's practice. This is now possible with a click of the mouse.

### ASN : What is your opinion on SpineBalance (SurgiView, France) ?

— Well, the philosophy is similar to that of Scolisoft, since it helps the surgeon decide for the strategy to adopt for a given patient, keeping in mind the particular features of each patient. I think that there are also a lot of complementary aspects in these two softwares, this is why we are looking into the possibilities to co-operate in the future.

**ASN : SpineBalance is based more on the modeling of different "patterns" of surgical correction of scoliosis and was mostly developed with well known scoliosis specialists who thoroughly described their strategies so that the engineers could put them into kind of a "black box" which they call algorithms. However, SpineBalance gives a more important role to the individual aspects of each patient than Scolisoft does. How useful does that seem to you for evidence based surgery ?**

## 2) Teaching of the patient

With increasing awareness of patients and their families, patients demand to understand and see what the result of the surgery is going to be on a condition that is similar to them. With the software it is very easy to showcase the patient a similar case to his condition show the patient what our treatment plan is going to be and what can be the anticipated result of the surgery with the natural understanding that there is art in the surgical science of surgical correction of spinal deformities.

## 3) Teaching of the surgeon

Young surgeons may not have the experience of their mentors and are often seeking advice for the treatment of their patients. With Scolisoft nothing is easier than this as you can have access to all the info of your peers. Benchmarking your own cases against another surgeon or the other is also very easy as you can review any information you want on the software such as blood loss, OR time, shoulder balance or complications.

## 4) Research quality assessment and medicolegal implications

If a surgeon wants to carry research out of the software, it is possible to review the cases without going back to medical archives as all the info required is on the software. Let us say one is interested to review if the pedicle screw instrumentation gives better balanced spine than classic multiple hooks anchors in adolescent idiopathic scoliosis. Nothing is easier than to go to the database and separate out these two groups and judge on the clinical pictures which one has given the best results in terms of shoulder balance. One can even review the cost impact of the number of implants and the final outcome. It is also possible for the patient to review very easily the shape of his back before and after the surgery. The software can comply with Hippa regulations, and the face of the patient and any identifiers never show in the software except for the treating physician. All the patients entered in the registry have signed an informed consent for future publication.

## Use of Scolisoft to query the surgical treatment of adolescent idiopathic scoliosis

In this example we were interested by the following query : right thoracic curves King 3 type or Lenke 1 A, Thoracic Cobb 50-55°, Lumbar Cobb 30-35°, Apex of the curve T9, end vertebrae T5-L1. Our query gave us 13 similar results out of 270 cases from our databank. By reviewing these 13 similar cases we could notice that cases stopped at L1 added on (increase of the lumbar curve) at two years follow-up. (see example page 32 of one patient before and after the surgery with a 2 years follow-up). On the other hand fusion stopped at L2 did not add on. We can therefore propose that fusion should be stopped at L2 for these specific curves. The patient with such similar curve undergoing surgery can have an anticipation of the expected result following such surgery.



Example of one of the results of the query we had for a King III right thoracic curve with an apex at T9 and end vertebrae at T5 and L5. Preoperative view of the patient with all the required information for decision making.



Postoperative and follow-up window in the same case. All the information necessary to judge the clinical and radiologic result of the patient appears on one window. Observe the slight adding on due too a short fusion at follow-up.

## Future directions of ScolioSoft

Currently ScolioSoft is soon going to be available on a web platform built by Stelian Chirila, Mark Adams and the AO Spine International. We are currently expanding our number of sites that enter surgical cases (from currently 5 sites to 10 sites) with the goal to always improve the quality of our treatment. As soon as the software will be on a web platform we shall start a multicenter prospective data collection that could serve as a control of evidence based medicine for the surgical treatment of spinal deformities. Collaboration with SurgiView and the SpineBalance software may also add another dimension to our registry and software as we shall get more input from the spinal deformity community and be able to come up with the reference software for spinal deformity. ●

### – Vincent Arlet

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### Acknowledgments :

Dr Bersusky from Buenos Aires  
Dr Helton Defino from Brazil  
Dr Jeffrey Shilt from Wake Forest University, NC  
Dr Marinus DeKleuver from the Netherlands  
Dr Hubert Labelle, and Jean Ouellet from Montreal for participating in the registry AO Spine international for their support.

— Well I think that both approaches lead to the same final point, which is decision making. I actually discussed these complementary aspects with people from SurgiView who developed SpineBalance and we both agreed on the fact that combining these tools might lead us to a new generation of software.

Regarding the usefulness of such software, I think that another major aspect is the education of the patient. Indeed, the patient comes to the clinic with a lot of questions, such as “Doctor, what are you going to do to my spine ? What are the risks ? What are the chances of success ?” and so on. Then you just have to go to the computer, look into the database for similar cases and show the patient the expected results. So the patient has a certain knowledge of what he has, of what can be done for him and of the anticipated outcome of the treatment, depending on different strategy options.

We are going to run a study on the patient’s satisfaction with and without ScolioSoft, but I can tell you by experience that when the nurses spend some time with the patient showing him the software and the results he could expect from the surgery, they are usually very happy.

Finally, the education of young surgeons must also be considered. We have young surgeons who perform only a few scoliosis surgeries per year so they do not have a huge experience. If they can have access to the software, it will provide them with a lot of information on similar cases, which is tremendously helpful for them.

So, if we want to summarize the role of such tools, we must consider : decision making for the surgeon, education of the patient and education of the surgeon, and naturally the great potential for clinical research.

With these in mind, the ultimate goal is to set the guidelines of what is good result and what is bad result or intermediate result for the evidence based medicine.

Of course, to do so, the first thing we need is a very large registry, because no guidelines could be set with just a few cases.

**ASN : Thank you very much, Doctor Arlet, for your rich input.**

Interview by Anca MITULESCU, PhD <

# Spinal implant industry outlook

— Robin R. Young, CFA

President, Robin Young Consulting and Publications  
Pennsylvania USA

**I**N MANY RESPECTS, the future has arrived in the spinal implant industry. United States spine surgeons joined their European counterparts in 2004 with the approval of Charite disc arthroplasty system. Motion preservation is now becoming an important part of the treatment plans for U.S. patients with degenerative disc disease. While the headlines have emphasized disc arthroplasty, it appears as though posterior dynamic stabilization products like Dynesis (Zimmer Spine), Isobar (Scient'x) and Wallis (Abbot Spine) are capturing the attention if not also dollars of surgeons seeking posterior, viable motion preservation treatments. By the end of 2006, we expect, there will be two dynamic stabilization products and between 2 and 3 disc arthroplasty systems approved for sale in the United States.

Motion preservation and biologic (including allograft and InFuse®) products will account for, we estimate, upwards of 35% of spinal implant revenues in the US in 2006. Presently, there are 40 motion preservation projects in various stages of development and clinical testing.

The industry's leader, Sofamor Danek, expanded its market share in 2004 and will, we think, be able to maintain a 41% share in 2006 on the strength of biologic products like InFuse® and the industry's broadest line of motion preservation products. Coming on strong are a new class of small to medium size spinal implant companies led by Abbott Spine and including Blackstone Medical, Globus Medical and Scient'x. DePuy Spine remains the second largest spinal implant manufacturer followed by Synthes Spine and Zimmer Spine.

While the US generates the greatest number of spinal surgery procedures, the incidence of back pain may be higher in Europe than in either the US or several of the more developed Asian countries. Recently we surveyed 18 studies of back pain incidence in Europe (3 from the Netherlands, 6 from the UK, 3 from Sweden, 2 from Denmark and the rest from Spain and Finland). These studies appear to show a higher incidence rate of back pain in the EU than in the US. In a Finnish study of 5,646 patients, for example, 40% reported back pain as the reason for their visit to the doctor. In a Swedish study of 35-45 year old males, 25% reported chronic back pain. Other studies which have attempted to aggregate the incidence of back pain in the EU have put it at 18% of the overall population. Assuming these studies are accurate, that would indicate that the EU back pain market is relatively immature.

## 2006 spinal surgery procedure volume estimates

Robin Young Consulting estimates

	EU	USA	Asia*
Population in largest spine markets	564 million	296 million	200 million
Back pain incidence	101 million	28 million	42 million
Total spine operations	270,000	1,398,000	132,000
Fusion operations	88,000	457,000	43,000
% Change	+5%	+9%	+3%

\*Japan, Korea, Taiwan & Hong Kong

In many respects, from reimbursement rates to delivery systems, the European markets are still developing and, as a result, represent a significant opportunity for both healthcare professionals and manufacturers. New technologies, we expect, will be the principal method by which the EU markets will expand. And, we believe, such technological improvements will not be limited to motion preservation.

## Spinal implant innovations 2004-2008

### ■ Traditional fusion instrumentation

- New Treatment Modalities
- Lower profile screws
- Increasing use of MIS access
- Motion Preserving Rods
- Low temperature cements
- Resorbable Load Bearing Plastics
- High BMP bone void fills

### ■ New treatment modalities

- 2nd Generation Disc Arthroplasty
- Growth Factors beyond BMP
- Facet Joint Arthroplasty
- Annulus Repair
- Disc regeneration
- Drug Delivery on Implants
- Time Release Peptides
- Anti-adhesion

Specifically, the area in which the EU may well pace the U.S. and the rest of the world will be in the development and use of biologic products to regenerate discs or repair deteriorating facets or damaged annulus. The EU, which has always been at the forefront of technological innovation for the treatment of both acute and chronic back pain may well be entering a period of extended market growth as a result of these technological strengths. The key will be the manner in which new technologies deliver both better patient outcomes and lower cost treatments.

Naturally, when these are proven in the EU, they will then follow the well established path to the U.S. and beyond. If these innovations are successful, and we believe they will be, it should drive, we estimate, a minimum of a 5% procedure growth and, potentially, even higher revenue growth for 2006. ●



Fig 1 : CT-scan L4-L5



Fig 2 : CT-scan L5-S1



Fig 3 : Xray



## Clinical case presentation

– Franck Ganem, MD  
Neurosurgeon, Caen FRANCE

**72** YEAR OLD WOMAN comes with a S1 right sciatica, complaining of medication resistant pain for over one year. She has already undergone 3 infiltrations, but she experienced no pain relief. Two months ago the sciatica increased and was associated to paresis sensation during walk, combined with ascendant rachialgia up to the cervical spine as well as unsystemic pain in the upper limbs. Clinical examination shows neither sensitive nor motor deficit. The right leg Achilles reflex is absent and the other reflexes seem a little too sharp. The spine is rather rigid with moderate low lumbar contraction. One year old medical images show a right side L5-S1 disc hernia and canal stenosis.

### What would you do in this case ?

- ① Further investigation (please specify)
- ② Discectomy only
- ③ Discectomy + recalibration only
- ④ Discectomy + recalibration + instrumented fusion
- ⑤ Other

## Call for comments

Dear readers,

All of you who are currently orthopaedic surgeons, neurosurgeons or spine surgeons are kindly invited to send us your comments and suggestions regarding the clinical case presented above. Please send all your comments and inquiries to :

Anca Mitulescu

[anca@argos-europe.com](mailto:anca@argos-europe.com)

or to Alexandre Templier

[a.templier@argos-europe.com](mailto:a.templier@argos-europe.com)

Your comments will be published in the next issue of Argos SpineNews to be edited in October 2005. Thank you in advance for your input.

The editorial board <



# Literature update

Key words : decision making & spine surgery  
Source PubMed [www.ncbi.nlm.nih.gov](http://www.ncbi.nlm.nih.gov)

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# Web review

**Orthopedic surgery appears on the internet in a variety of contexts ranging from academic institutional websites and websites for commercial ventures to personal webpages for individual surgeons.** Educational material and product information is now available around the clock.



## The Guidelines International Network (GIN)

[www.g-i-n.net](http://www.g-i-n.net)

The GIN is an international not-for-profit association of organisations and individuals involved in clinical practice guidelines. Founded in November 2002, GIN has now grown to 53 member organisations including WHO from 26 countries. GIN seeks to improve the quality of health care by promoting systematic development of clinical practice guidelines and their application into practice, through supporting international collaboration. GIN's guideline library contains regularly-updated information about guidelines of the GIN membership. In December 2004 about 2700 programmes are available. The aims of GIN are :

- to facilitate information sharing, education and knowledge transfer, and collaborative working between guideline programmes to promote best practice and avoid duplication of effort
- to improve and harmonise methodologies for systematic guideline development in existing and new guideline programmes
- to improve methodologies for dissemination and implementation of

clinical practice guidelines and evaluation of their effects

- to identify priorities for and support research relating to guideline development, dissemination, implementation, evaluation, and to facilitate the application of research findings into practice



## The Critical Appraisal Skills Programme and evidence-based practice (CASP)

[www.phru.nhs.uk/casp/casp.htm](http://www.phru.nhs.uk/casp/casp.htm)

CASP is a programme within learning & development at the public health resource unit. Since 1993 the programme has helped to develop an evidence-based approach in health and social care, working with local, national and international groups. CASP aims to enable individuals to develop the skills to find and make sense of research evidence, helping them to put knowledge into practice. CASP's workshops and resources are in three main areas of work which are reflected in CASP's three-arrow logo : finding research evidence, appraising research evidence, and acting on research evidence.

## Evidence based medicine

<http://ebm.bmjournals.com>

BMJ publishing group and McMaster university's health information research unit are collaborating to provide you with access to current best evidence from research, tailored to your own health care interests, to support evidence-based clinical decisions. This service is unique : all citations (from over 110 premier clinical journals) are pre-rated for quality by research staff, then rated for clinical relevance and interest by at least 3 members of worldwide panel of practicing physicians.



## Center for evidence based medicine

[www.cebm.net](http://www.cebm.net)

The centre has been established in Oxford as the first of several centres around the country whose broad aim is to promote evidence-based health care and provide support and resources to anyone who wants to make use of them. Their prospectus outlines the specific aims of the centre and the goals they have identified, as well as the means they propose to use in achieving those goals.



### Health Information Research Unit (HIRU)

<http://hiru.mcmaster.ca>

The HIRU at McMaster university conducts research in the field of health information science and is dedicated to the generation of new knowledge about the nature of health and clinical information problems, the development of new information resources to support evidence-based health care, and the evaluation of various innovations in overcoming health care information problems. Their mission "... is to improve the effectiveness and efficiency of health care by providing innovative evidence-based information products and systems to health professionals, patients, policy makers, and the public"

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## Chirurgie du Rachis

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### Thèmes abordés :

- rachis dégénératif
- déformation rachidienne
- traumatologie
- infection
- tumeur
- complications
- chirurgie mini-invasive

#### Organisateurs/intervenants :

Jean-Louis Husson  
Pierre Kehr  
Christian Mazel  
Jean-Paul Steib

#### Intervenants :

J. Allain	M. Gayraud
P. Anract	Ph. Girard
P. Antonietti	D. Grunenwald
L. Balabaud	M. Guillaumat
T. Bégué	JM. Hamon
P. Chatellier	J. Lombard
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J.C. Dosch	JF. Mathe
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*Début des cours  
Novembre 2005*

# Devaspim : a European project for the design of an internet based tool for preoperative planning of lumbar spinal surgery

The Instituto de Biomechanica de Valencia (IBV—Biomechanics Institute in Valencia SPAIN) together with several renowned European research, clinical and industrial partners\*, has recently developed an expert system for preoperative planning for degenerative lumbar spine surgery. This tool is based on numerical simulation and consists of an internet link ([www.mywebspine.com](http://www.mywebspine.com)) that allows surgeons to perform a study of the spine's behavior in different situations, depending on the pathology, the levels involved, the instrumentation and patient's features. The study is facilitated by the use of a finite element model of the injured spine. The model is built almost instantaneously according to different criteria listed above.

The Devaspim research program has recently come to an end. However, the results of the study were judged highly encouraging and the project tremendously valuable for the potential users. Therefore, the European commission decided to co-finance the second part of this project, meant to better adapt the existing tool to the market and better address the end users needs. A second European program for the same project is incredibly rare, which means that the project certainly met the expectations of European commission jury and those of the partners involved.

This is why the Argos editorial board decided to publish a short overview of this interesting project. To do so, we met Virginie Lafage, PhD, from the Laboratoire de Biomécanique (LBM—Biomechanics Laboratory), ENSAM, Paris, who has been involved in the project from the beginning, and Thomas Mosnier, Research engineer, who will carry the project forward for SERAM-LBM.

\* Consortium partners : Adapting (ES), IBV (ES), SurgiView (FR), SERAM-LBM (FR), Laffit (ES), Scient'x (FR), Praxim (FR), Selgado Orthopaedics (PT)



## Why ?

In most cases of degenerative diseases of the lumbar spine, when conservative treatment such as medication with anti-inflammatory drugs, analgesics or brace wear fail, surgery remains the only option to relieve pain and stabilize the spine and restore a certain functional balance. However, each patient is unique and surgical planning must be individualized. The surgeon must deal with several variables : diagnosis, approach, instrumentation, levels involved and patient specific features, such as age, bone quality, posture and balance related biomechanical parameters, overall condition and so on. Balancing all of these variables is, perhaps, the most difficult task facing the spinal surgeon : What implant for what pathology ? How long a construct to avoid excessive stress ? Posterior approach, anterior approach or both ? The surgeon must address all these questions during the surgical planning.

Besides the usual questions related to patient condition and pathology, the surgeon has to choose among the large variety of implants available on the market. These implants are continuously evolving and new ones seem to appear every day.

In this context, IBV together with several spinal implant manufacturers and health care centers in Europe decided to

develop a specific tool for the preoperative planning of lumbar spine surgery to be accessible via the Internet. This tool is based on finite element modeling and simulation, making it possible for surgeons to integrate this advanced numerical method into their daily clinical practice.

To coordinate all these requirements, the new tool was designed to evaluate the biomechanical behaviour of spinal implants, to reduce the surgical pitfalls associated with inappropriate constructs and, last but not least, to open a communication channel between surgeons and implant manufacturers.

## How does it work ?

A group of expert spine surgeons from three countries (France, Spain, Portugal) worked on the definition of the different pathological configurations and of the appropriate instrumentation according to these configurations. The group of implant manufacturers provided the mechanical characteristics of their products as well as all other design features required for the modeling of the implants' behavior. Then the two biomechanics laboratories, Instituto de Biomecnica de Valencia, Spain, and Laboratoire de Biomécanique, ENSAM, Paris, France, jointly developed the corresponding finite elements models, taking into account spinal anatomy, boundary conditions in a pathological context, various implants configurations and ultimately patient-specific features, extracted from lumbar sagittal Xrays and from clinical records. Once models were developed, an in vitro validation process was performed to confirm the adequacy of the finite element models for the injured spine, for different implants, and for the completed model of the instrumented spine.

The role of the spine experts is paramount in the model development as boundary conditions must be as realistic as possible and the various decompression alternatives – laminectomy and laminotomy, arthroectomy and discectomy – must be accurately simulated so that the model can be as close to the real spine as possible.

Even as the model was being designed and validated, the application was structured to integrate patient's individual features, such as age, quality of bone mass, imbalance, weight and height. To these, the surgeon will add a sagittal



*Customized simulation of spine surgery results using the available implant systems using the Devaspim automatic simulation tool based on clinically validated biomechanical spine models*

Xray allowing him to extract anatomical quantitative measurements that are required for model customization. Finally he will have to choose the pathology, the instrumentation, and indicate what kind of decompression will be performed, and where.

Depending on his own requirements, the surgeon will be provided with a full range of mechanical data describing the behavior of the instrumented spine model, after customization, i.e. biomechanical behavior of the spine and implant assembly ; stiffness ; stresses in the rod and screws ; adjacent vertebra mobility.

In other words, the simulation will only predict mechanical behaviour of a spine and implant construct,

## About...

### Thomas Mosnier, PhDc

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Thomas Mosnier graduated in general engineering in 2002. He prepared his graduation thesis at the Biomechanics Laboratory of Paris (ENSAM) on the "In vitro characterization of the proximal femur under compression for fracture risk prediction". In 2004 he earned his Master of Sciences in Biomedical Engineering, Biomechanics Laboratory of Paris (ENSAM) with a thesis on the "Effect of different techniques of decompression of spinal stenosis on Lumbar Spine flexibility and Mechanics in Shear loading for different spinal levels".

In parallel to his academic activities and training, Thomas Mosnier has worked as a research engineer at the Biomechanics Laboratory of Paris between 2002 and 2004. His responsibilities included, but were not restricted to, the different aspects of spinal implants evaluation (most of the times in collaboration with spinal implants manufacturers), focussing both on biomechanical aspects on normative and clinical ones.

Since January 2005 he started a PhD research programme in Biomechanics at the Biomechanics Laboratory of Paris (ENSAM) on the "Biomechanical analysis and evaluation of spinal implants". ●

in a given situation defined by the surgeon himself. However, the surgeon remains master of his own decisions on whether to take this prediction into account or not and he is the only one who could eventually provide the clinical significance of mechanical failure or success.

Today this tool has been applied retrospectively to a series of 60 patients who underwent lumbar spine surgery for degenerative diseases. In four cases, the simulation predicted screw breakage due to overstress. The clinical records show that the four patients did experience screw breakage post-operatively.

This preliminary validation in a clinical context is quite encouraging. However, a larger number of patients need to be included in the study in order to fully validate the accuracy in different failure/success configurations.

Needless to say, this validation on a larger scale will certainly provide the biomechanics teams with highly useful information for the optimization of the model and of the simulation procedure.

This validation study has already started and will be conducted by Thomas Mosnier, Eng, within his PhD research program at the LBM-ENSAM-CNRS.

In parallel to this research project, clinical and radiological data are being collected within the thesis work of another PhD program, conducted by Sabina Marcovschi Champain in the same laboratory. Her research focuses on predictive factors of success and failure in degenerative lumbar spine surgery and consists of analyzing a complex set of biomechanical, radiological, clinical and psycho-social factors in order to better understand surgical outcome. The link between these two projects, both in the research team led by Pr Skalli, is obvious, as one will probably provide with data on main and secondary parameters to be taken into account within the simulation process, while the other will integrate these results into the biomechanical model and eventually optimize the accuracy of the simulation process.

Last but not least, to ensure full success of this European initiative, an objective market validation study is currently in progress in several European countries under the eTEN project "Market validation of a simulation service provider for orthopaedic surgery", also known under the name Orthosim. ●

Virginie LAFAGE, PhD <  
Anca MITULESCU, PhD <  
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## About...

### Virginie Lafage, PhD

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Virginie Lafage earned her master of sciences in biomedical engineering from the ENSAM (École Nationale d'Arts et Métiers), in Paris,

France, in 1999. In 2002 she defended her PhD thesis in biomechanics on the "Finite element simulation and biomechanical analysis of the scoliosis surgery using Cotrel-Dubousset instrumentation". Her PhD research program was conducted at the LBM-ENSAM, under the responsibility of Pr Wafa Skalli and Pr Jean Dubousset. Later on Virginie Lafage worked as a research engineer in the same laboratory and further on as a postdoctoral fellow. Her research covered a large range of biomechanical topics, such as the biomechanical study of spinal instrumentations (posterior-implants, spinous spacers, disc prosthesis) using in vitro experiments and finite element modeling and the development of a telematic tool based on finite element simulation for the prediction of mechanical failure in the lumbar spine surgery (Devaspim European project). Mrs Lafage is currently a research engineer at the LBM-ENSAM where she coordinates industrial partnership research programs for the laboratory. ●

## Call for clinical and industrial partnership

**Clinical validation :** all spine surgeons who are interested into this project and would like to bring their contribution to the clinical validation of the simulation tool are kindly invited to contact the Laboratoire de Biomécanique, ENSAM, Paris or SurgiView for collaboration.

– **Thomas MOSNIER**  
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**Industrial participation :** all orthopaedic implants manufacturers who would be interested in having their implants integrated into this internet service, are invited to contact :

– **Alexandre Tempplier**  
SurgiView  
64, rue Tiquetonne  
75002 Paris FRANCE  
+33 (0) 1 42 33 06 88  
+33 (0) 1 42 33 06 62  
a.templier@surgiview.com  
www.surgiview.com

## What is eTen ?

**eTEN is the European community programme designed to help the deployment of telecommunication networks based services (eServices) with a trans-European dimension.**

It focuses strongly on public services, particularly in areas where Europe has a competitive advantage. The programme aims to accelerate the take up of services to sustain the European social model of an inclusive, cohesive society. Its objectives are at the very heart of the eEurope mission of "an information society for all". It promotes public interest services which give every citizen, enterprise and administration full opportunity to gain from the eSociety.

Source : [http://europa.eu.int/information\\_society/activities/eten/index\\_en.htm](http://europa.eu.int/information_society/activities/eten/index_en.htm)

## Market validation of a simulation service provider for orthopaedic surgery

(Acronym : ORTHOSIM, proposal Number : 517509, coordinator : Adapting, SL)

### Objective of the project

The objective of this proposal is to validate the potential market at European scale for introducing a new telematic service concept : the simulation service provider for orthopaedic surgery (Orthosim) mainly aimed at the hospitals and health administrations, the orthopaedic surgeons community, the orthopaedic manufacturing companies and biomechanical research teams.

The Orthosim services are provided by means of a telematic platform allowing users to access to human joint analytic models for simulating orthopaedic implants, in order to perform a better pre-operative planning and to optimize the implant design process. The aim of this eTEN project is to evaluate the actual biomedical market, the capability of the users to absorb this service and the cost of the adaptation of this service to any new market, which may determine the viability of the service. The services provided by Orthosim that will be validated individually are :

### Simulation services

The possibility of simulating a personalised instrumented human joint in different situations.

### Information services

Creating a database of clinical cases accessible for any accredited user and a virtual community of high skilled professionals. The users will be able to acquire better knowledge and comprehension of the biomechanical behaviour of the instrumented human joints by simulating many configurations and conditions, by consulting the database or by communicating with a virtual community of highly specialised users.

**Integration services** of new implants and of new (validated) simulation models. Biomechanical models can be integrated into the Orthosim platform service to make them available for any user. The model has to follow an adaptation process before being integrated in the service.

### Criteria for success

Orthosim is based on the developments from a prior IST Craft project called Devaspim, which was an RTD project focused on developing and validating a finite element model of the lumbar spine and connecting it to the user community through an e-commerce interface. Orthosim aims to enlarge the service to other human joints by

performing an adaptation to new models according to a specific integration protocol to be defined during the project.

Virtual modelling offers the possibility to analyse the mechanical properties of implants and implant-human systems. These techniques permit to minimise technical failures due to inappropriate configurations through a better pre-operative planning, and optimise design process of implants by reducing failure due to bad design, thus improving competitiveness of the European implant industries.

**The consortium** proposed represents the major stakeholder categories of the Orthosim market (see table).

The two industrial SMEs that are beneficiaries are interested in the continuation of this project, since both are complementary and devoted to information and communication technologies. SurgiView develops and sells software products for clinicians, particularly surgeons. Adapting designs, develops and integrates telematic applications for many purposes including advanced portals and medical applications.

The two RTD beneficiaries are very interested in the success of the service, since both can herewith exploit their expertise, eventually finding new channels to boost innovative and at the same time socially qualified research initiatives.

Consortium partners		
Adapting		eBusiness and telematic applications
IBV		Biomechanic research center
SurgiView		Medical software for orthopaedic surgery.
SERAM-LBM		Biomechanic research center
IN2		Internationalization and business cooperation
Liffit		Implant design and manufacturing company
Scient'x		Implant design and manufacturing company
Argos		Professional association of orthopedic surgeons
Online&Service		eServices for handicap people
CUT		Technology transfer centre
IDS CR		IT business consultant
H. Ribera		Private health institution
H. Sagunto		Public administration and health institution

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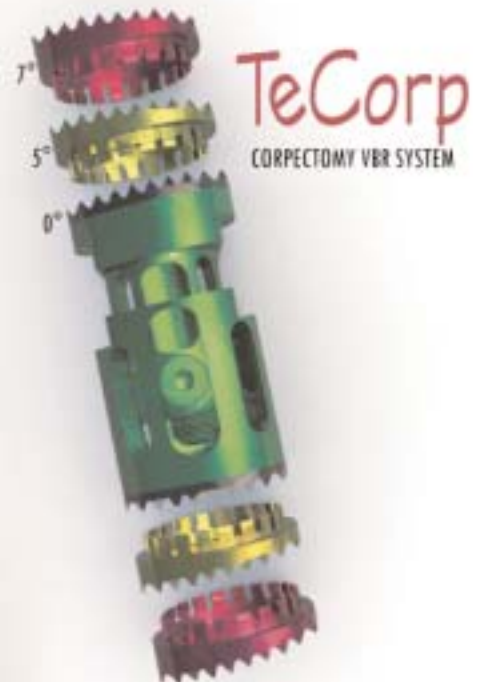
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