



The International
Society for Fracture
Repair

THE INTERNATIONAL SOCIETY FOR FRACTURE REPAIR

NEWSLETTER
January 2009



Osteoporotic
Fracture Campaign



From the President,

As the New Year has just started, I would like to extend to all members of our society and their relatives my best wishes for a happy and successful year 2009.

For this coming year the goal of the International Society for Fracture Repair is to finalize our registration process in Switzerland and also to streamline some organizational processes within the ISFR. The registration process takes longer than expected because we have to prepare bilingual versions of the Bylaws which have to be reiteratively reworked. But we hope that we will be able to submit the Bylaws in due course to all the members for approval.

Meanwhile, we are working on updating our membership database on our website at www.fractures.com. We like to provide each member access to their own membership profile in order to keep the information we have from our members up to date. Please visit our website for new announcements and anticipated changes.



Faculty at the ISFR symposium on Biophysical Stimulation on Bone and Fracture Healing in Kyoto, Japan

Unfortunately we were affected by the recent political situation in Bangkok/Thailand which led to the cancellation of the World Congress of Osteoporosis by the International Osteoporosis Foundation. This in turn had a bearing on our symposia and workshops. We had however, a very successful symposium in Kyoto, Japan from November 26 through November 28, 2008 organized by Prof. Takashi Matsushita. The title of the symposium was "Biophysical Stimulation on Bone and Fracture Healing" with the purpose to discuss effects of biophysical stimulation on bone remodeling and fracture healing. As always, the symposium was a full success and we are awaiting a brief summary of the symposium to be published on our website.

One of the events we had planned during the Osteoporosis World Congress in Bangkok was a Workshop on osteoporotic fractures in the spine. Due to the efforts of our active organizing committee, including Mo Akmal, Antonio Moroni, and Stefan Goemaere we were able to relocate this workshop which will now be held in St. Mary's Hospital, London, UK on March 13-14, 2009.

Finally I would like to invite you to renew your membership to the International Society for Fracture Repair. Payment of membership fees must be online on our web portal **<http://www.fractures.com/payment.html>**, by bank transfer or credit card. In order to keep all administrative overhead as low as possible, we would strongly encourage you to use online payment. A valid credit card is needed for the secure online transaction.

If you prefer not to use our online payment system you may use the attached form for credit card payment or payment by cheque.

All inquiries regarding our society should be addressed to our coordinator

Amy Hoang-Kim, who can be reached by
Telephone or Fax at +39 051 636 6581
or through her E-Mail address: isfr.fractures@gmail.com



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PRESIDENT
Peter Augat
BG Unfallklinik Murnau
Prof-Kuntscher-Sr.8, 82418 Murnau
Germany
Tel: +498841/48-4563
Fax: +498841/48-4573
Email: biomechanik@bgu-murnau.de

TREASURER
Jörg Goldhahn
Schulthess Clinic
Lengghalde 2, 8008 Zurich
Switzerland
Phone: +41 44 385 7580
Fax: +41 44 38 7580
Email: joerg.goldhahn@kws.ch

SECRETARY GENERAL
Takashi Matsushita,
Department of Orthopaedic Surgery
Teikyo University School of Medicine
Japan.
Tel: +81-3-3964-4096
Fax: +81-3-3964-1516
E-mail: takashi@matsushita.net

ISFR Symposium in Kyoto – PART I
Symposium on Biophysical Stimulation on Bone and Fracture Healing
Meeting Chairman: Takashi Matsushita

This symposium was held in Kyoto, Japan from November 26 through November 28, 2008. The purpose of the symposium was to discuss the effects of biophysical stimulation on bone remodeling and fracture healing. Fifteen invited speakers and moderators from the United States, Europe, and Japan presented twenty-four papers (30 minutes each) and discussed topics for more than six hours during the three days. Specialties of the speakers and moderators were grossly divided into three categories: cell biology, biomechanics, and clinicians (orthopaedic surgeons and dentists).

November, 26 Mechanical Stimulation on Bone Architecture

Saito (Japan) et al. presented that collagen cross-links were thought to be a determinant of bone quality and that low intensity pulsed ultrasound had beneficial effects on collagen enzymatic cross-link formation to improve bone quality. Rubin (USA) et al. performed the experiments under assumption that the ability of exercise to decrease fat mass and increase bone mass may arise through mechanical biasing of mesenchymal stem cells (MSCs) away from adipogenesis and towards osteoblastogenesis. They reported that the entry of MSC into an adipogenic lineage could be suppressed by mechanical signals, and that strain permits the influence of signals that promote osteogenesis; therefore, the positive effects on both fat and bone may occur at the level of mesenchymal lineage selection. Rubin presented another paper and speculated that low magnitude (<0.4g) mechanical signals reduce adipogenesis and strengthen the

musculoskeletal system as much by defining the fate of MSCs as influencing the resident cell population within bone, muscle, or fat. Through the use of climbing exercise models in mice, Sakai (Japan) et al. reported that skeletal loading enhances osteoblast differentiation and inhibits terminal differentiation of adipocyte progenitors with high expression of PTH/PTHrP receptor in bone marrow cells. Duda (Germany) reported that mechanical loading of MSCs seems to result in both a paracrine effect by an enhanced stimulation of angiogenesis and also an autocrine impact by modulating MSC function through alterations in matrix metalloproteases (MMP) activities. Adachi (Japan) proposed a rate equation of trabecular surface remodeling and developed a simulation method using voxel finite elements in order to investigate three-dimensionality of the trabecular structure. He stated that the predicted trabecular structure was very similar to that in the actual proximal femur, implying that trabecular remodeling aimed at local stress uniformity yields functional adaptation of bone as a load-bearing structure. Jacobs (USA) et al. presented a very unique paper entitled "Primary cilia as mechanosensors in bone". They have found primary cilia, now considered to be a fluid sensing organelle although once commonly thought to be vestigial organelles, in both osteoblastic and osteocytic cell lines as well as in osteoblasts and osteocytes in vivo. They found that primary cilia were a component of the mechanotransduction pathway for PGE2 release but, distinct from the kidney, did not play a role in intracellular calcium mobilization. Gross

(USA) et al. superimposed transient quadriceps paralysis upon a standard rat closed femur fracture model and found that loss of quadriceps function severely inhibited normal fracture healing and compromised both morphologic and structural aspects of the repair process. Leung (Hong Kong) studied the effect of low-magnitude high-frequency vibration (LMHFV) on fracture healing in rats and stated that LMHFV promoted callus formation and callus mineralization which led to higher rates of healing and better mechanical outcomes in osteoporotic fractures. He showed the potential of clinical applications of LMHFV on osteoporotic fracture healing and offered insights for further mechanism studies and clinical trials.

Rittweger (UK) reported that maintenance of habitual loads was crucial for the maintenance of our skeleton and it seemed to be important to elicit peak forces; but excessive numbers of repetitions, such as in endurance running, could be detrimental due to formation of microdamage and subsequent material fatigue.

Part II & III covering November 27 & 28 on topics such as Mechanical Stimulation on Fracture Healing as well as Low Intensity Pulsed Ultrasound (LIPUS) Stimulation on Fracture Repair will be reported in our subsequent Newsletters. Stay tuned...

Report from Chair of the Osteoporotic Fracture Campaign
Osteoporosis Highlights presented at ISFR's 11th Biennial Conference
Antonio Moroni, MD
Rizzoli Orthopaedic Institute, Bologna, Italy

The year 2008 has come to a close and as the Osteoporotic Fracture Campaign moves forward, we like to look back and acknowledge the evolution of this field over time. For instance, progress has certainly been made as we have more than created a dent in the field of orthopaedics. Clinical trends towards the management of patients with fragility fractures and fracture treatment in the elderly is increasing in the literature and research studies. At the 11th Biennial conference a few highlights are worth mentioning. **Humeral fractures.** J Lin (National Taiwan University Hospital, Taipei, Taiwan) presented on the Successful Locked Nailing with Interfragmentary wiring for humeral nonunions with osteoporosis or comminution. Severe osteoporosis or comminution often compromises plating for humeral nonunions. The investigators added a figure-of-eight interfragmentary wiring to the locked nailing for fragment compression to reduce the fracture gap and increase the fixation stability in 62 consecutive patients (mean age 58.6 yrs with an avg duration of non union of 18.5

months). Nonunions were located at the proximal third in 10, middle third in 37 and distal third in 15. With a single operation, 60 patients achieved union with an average time of 19.6 weeks. One patient had second revisional nailing and wiring because of wire breakage. Two patients had thin visible radiolucent line upon radiological analysis 2 and 2.5 years following surgery. There were no significant differences about the healing rate and functional recovery between the allograft group and autograft group. **Fracture healing.** P Augat (Biomechanics Trauma Center Murnau, Germany) hypothesized that trabecular bone around the site of a diaphyseal fracture is considerably diminished during the course of fracture healing and that this loss can be partly compensated by antiresorptive therapy. The investigators conducted an animal study in 45 Sprague Dawley rats dividing them into three groups: Ovariectomy (OVX), sham operation (NON-OVX) and OVX with bisphosphonate (ibandronate) treatment (OVX + BIS). After four weeks of healing both femurs were excised and scanned with Micro CT

to analyze bone architecture in the femoral head. There was significant osteopenia due to ovariectomy ($p < 0.001$). The fracture itself induced a similar osteopenia at the ipsilateral femur. In OVX animals the fracture induced osteopenia and was potentiated by ovariectomy and amounted in a total bone deficit of 60% compared to healthy cancellous bone. Bisphosphonate treatment significantly reduced both the OVX and fracture induced osteopenia. In conclusion, the investigators state that it is therefore important to consider prevention measures for osteoporosis during the course of fracture healing in osteoporotic patients.

Biomechanics. J Cartner (Memphis, TN) et al evaluated the maximum stripping torque and pull-out strength of the PERILOCTM 5.0 mm Osteopenia Bone Screw using an osteopenic model. The PERILOCTM 5.0 mm Osteopenia Bone screws showed a 34% increase in stripping torque and a 40% increase in pull-out strength ($p < 0.01$) as compared to clinically successful bone screws. These findings indicate that the use of the improved thread design is advantageous in poor quality bone. T Russell (Campbell Clinic, Germantown TN) compared three types of fixation in osteoporotic bone under physiological cyclical loading condition in a cadaveric proximal third tibia fracture model. Eight matched pairs of osteoporotic fresh frozen cadaveric tibiae (BMD 0.6 C 0.9 g/cm², 72 C 83 year old female) were utilized. A 5mm gap between proximal and distal fragments was created. One of the cadaveric tibias from each matched pair was implanted with a TriGen META Tibial Nail ($n=8$) (Smith & Nephew Inc, Memphis TN) or a T2 Tibial Nail ($n=3$) (Stryker Orthopaedics, Mahwah, NJ) of the same size. Both the META Nails and the Knee Nails were minimally reamed to 1.5 mm over the appropriate nail diameter and statically locked. The T2 Nail was inserted without reaming and was statically locked. Reaming was deemed as not required due to the poor bone quality. The constructs

were cycled at a frequency of 2 Hertz until failure or run-out to 500,000 cycles. Axial compression stiffness measurements and torsional stiffness measurements were taken at each 50,000 cycle interval. The authors concluded that under the physiological loading conditions used in this study, the META Nail would be a beneficial option for the treatment of proximal third tibia fractures in osteoporotic bone.

Outcomes. In a systematic review of the functional outcome instruments in randomized clinical trials evaluating postoperative hip fracture management and rehabilitation in the aged by A Hoang-Kim (St. Michael's Hospital, Toronto, Canada), it was shown that there was an overall trend towards studies assessing functional recovery as a primary outcome as opposed to assessing measures of impairment. However, none of the measures were used consistently. A lack of standardized assessment in these groups of patients may overestimate treatment effects. **Rheumatoid arthritis.** L Belletti (University of Modena & Reggio Emilia, Modena, Italy) et al analyzed the correlation between age, sex, rheumatoid arthritis duration, corticosteroids administration and presence of fractures in osteoporotic patients under Vitamin D therapy. In 100 consecutive patients, they found that no males had fractures regardless of age, rheumatoid arthritis duration and corticosteroid therapy. Women suffering from RA for 3 years developed fragility fractures. Women suffering from the disease for less than 3 years did suffer from fractures.

Secondary Fracture Prevention Programs. The FORWARD program in Belgium lead by S Goemaere et al (Ghent University Hospital, Ghent, Belgium) deserves credit for putting forth a secondary fracture prevention program intended to improve osteoporosis care in fracture patients in Orthopaedic Wards. The FORWARD referral program for fracture patients in orthopaedic wards for DXA investigation and osteoporosis

specialists' advice resulted in the identification of osteoporosis in 27% of all fracture patients. Implementing effective measures and treatments for fracture prevention in this high risk population could lead to cost-savings in the short term. However, the investigators claim that further initiatives on patient flow needs to be elaborated and maintained by an active local care organisation.

Recently, the topic of fragility fractures has been featured as an additional report in the Specialty Update Reports in Trauma in the Journal of Bone and Joint Surgery (Cole P, Miclau T, Ly T et al. What's new in orthopaedic Trauma. J Bone and Joint Surgery 2008; 90: 2804-22). And if you are an ISFR member, you can login to the member area to see the abstracts listed above, International Society for Fracture Repair Website: www.fractures.com.

Report from **Amy Hoang-Kim**
International Society for Fracture Repair Coordinator
Osteoporotic Fracture Campaign Steering Committee

OFC Workshop Part III: Secondary Fracture Prevention and the Interaction of Osteoporosis Drugs with the Biology of Fracture Healing

The third session held in Byron Bay, New South Wales Australia on November 20 a year ago was to discuss: **Systems for effective delivery of secondary prevention and fracture stimulation—chronic disease perspective** chaired by D. Marsh (London, UK), and I Reid (New Zealand).

It is apparent from the various regional perspectives which were compared that an integrated secondary fracture prevention delivery system needs to be tailored to the individual healthcare system. The USA health system was presented by G. Friedlander (USA), Asia and Australasia healthcare, by T. Matsushita (Japan) and S Bavonratanavech (Thailand) and European OP initiatives by A Hoang-Kim (Italy) and P Mitchell (UK). It is shown that secondary fracture prevention should be integrated into multimodal care, which includes acute geriatric-medical support, appropriate supplementation with calcium and vitamin D, nutrition as well as falls assessment. Recently, several international organizations, including the International Osteoporosis Foundation, the Bone and Joint Decade and the International society for Fracture Repair

(Osteoporotic Fracture Campaign) have jointly advocated a systematic approach to the provision of secondary prevention as a means to close the current global management gap.

“Based upon our experience of successful program development and implementation in the UK, Europe, Asia and the Antipodes the rationale for these services must be focused on reduction of fracture risk rather than osteoporosis per se; this might seem like a statement of the blindingly obvious but is of central importance to the secondary fracture prevention cause.” P Mitchell says.

Ego (US) amongst others has demonstrated that the majority of fragility fractures emanate from the osteopenic population rather than those with osteoporosis.¹ The authors randomly selected from a population with one major health provider and three radiological centres so that fracture ascertainment is complete and validated.² The focus on osteoporosis, i.e. the risk factor, rather than fragility fracture, i.e. the clinically important end-organ damage, may be a key contributory factor to the global

collective failure to manage patients at highest risk, i.e. those with existing fragility fractures.

In a systematic review of the literature, 37 articles were reviewed in full: 29 of which reported on rates of OP treatment in persons who sustained fractures, 4 described intervention studies to increase OP diagnosis and treatment in patients who sustained a fragility fracture and four conducted surveys of orthopaedic surgeon and family physician practice patterns for fragility fracture and OP.³ Furthermore, 11 articles were cross-sectional, 15 retrospective, 2 case-control and 1 prospective cohort. Hegeman from the Netherlands in 2004 reported the development of an outpatient fracture and osteoporosis clinic.⁴ Chevalley in Switzerland in 2002 developed a program and demonstrated that the most difficult step was getting the patients to the treatment.⁵ Astrand (Sweden, 2006) developed an inpatient osteoporosis pathway for fragility fracture patients. The patients were screened by a nurse, followed by a computerized entry log of ER, review of x-rays, ICD-code of diagnosis from the orthopaedic department database, questionnaire given on OP risk factors, and patients encouraged to follow-up with family physician for OP assessment and treatment.⁶ Selected patients were

also referred to an endocrinologist for assessment of their bone health.

McLellan (Glasgow, 2003) developed a fracture liaison service that assumed responsibility for fracture case-finding and for assessing and performing diagnostic evaluations, and making specific treatment recommendations for the secondary prevention of osteoporotic fractures.⁷ All programs included orthopaedic staff who maintained lists of fracture admissions, used accident and emergency and general hospital IT systems to track patients, and worked with clinical secretaries in the orthopaedic department to obtain all reports relating to new inpatient and outpatient fracture attendances that are routinely sent to primary care physicians from the orthopaedic consultants. With great success is the Osteoporosis Exemplary Care Program by the Canadian team led by E Bogoch with its primary program goals to: Identify, Educate, Evaluate, Treat and Refer.^{8,9}

In conclusion, there are still numerous challenges faced in setting up a clinical system for secondary fracture prevention and the ultimate integration of patients into the care pathway has to be realised on a multidisciplinary basis and is the responsibility of the treating physician.

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Principles of Surgical Research Courses: Global Dissemination

Report from Mohit Bhandari,
Hamilton, Canada

The current culture of evidence-based surgery mandates a fundamental understanding of the principles of surgical research. The paucity of high quality training opportunities for surgeons, surgical trainees and surgical research coordinators poses significant barriers to improving both our understanding of the principles and practice of clinical research. In partnership with the Osteosynthesis and Trauma Care Foundation, Dr. Mohit Bhandari has led several global research training courses targeted for surgeons. Courses have spanned the globe from North America, Europe to Asia. With over 2000 attendees worldwide, the "Principles and Practice of Surgical Research" course has gained momentum as a stand alone resource for surgeons who are interested in developing their skills as clinical researchers.



The course was recently held in Canada (November 2008) with co-chairs, Mohit Bhandari and Emil Schemitsch. The course is the second in a planned annual Canadian research course for surgeons. In 2009, the course will be delivered in Greece, USA, Canada and France. Most recently, Drs Bhandari and Joensson have edited a textbook: *Clinical Research for Surgeons* (<http://www.thieme.de/detailseiten/9783131439314.html>) to serve as a companion text to the Principles of Research Course.

Clinical Research for Surgeons is a practical guide for understanding, planning, conducting, and evaluating surgical research. It covers the principles of evidence-based surgery, the standard benchmark guiding clinical practice, and applies these principles to the design of suitable research studies. The reader will come to fully understand important concepts such as case-control study, prospective cohort study, randomized trial, and reliability study. The book provides valuable discussions of the critical appraisal of published clinical studies, allowing the reader to learn how to evaluate the quality of such studies with respect to measuring outcomes and to make effective use of all types of evidence in patient care.

Highlights:

- Insights from experienced surgeons and veteran researchers
- Easy-to-reference text boxes with Key Concepts, Jargon Simplified, and Examples from the Literature
- Coverage of both open and minimally invasive surgical procedures
- 105 illustrations demonstrating key points

Why is the secondary prevention of fragility fracture important? – The Australian Reality

By Professor Nick Fazzalari PhD; nick.fazzalari@imvs.sa.gov.au



“Many osteoporosis patients leave hospital with their fracture treated but their osteoporosis undiagnosed, uninvestigated and untreated. Re-fracture rates can be reduced by targeting assessment and treatment at patients who have previously sustained fractures.”
Nick Fazzalari, Adelaide, Australia

Osteoporosis is a common, yet under-diagnosed and undertreated musculoskeletal disease characterized by low impact bone fractures. Approximately half of women and one third of men aged over 60 will sustain a fracture in their lifetime. Importantly, Inderjeeth *et al* recently identified a significant lack of awareness, diagnosis and treatment of patients with documented fracture up to six months following discharge from a tertiary hospital institution in Australia, even in the high-risk, osteoporotic fracture group.⁵ It has been shown that fragility fracture is associated with significant rates of morbidity and mortality, particularly in the case of hip fractures, and places the individual at a considerably increased risk of further fractures.

Osteoporosis costs Australian taxpayers an estimated \$7.4 billion per annum, claiming over 25,000 lives in 2000–01 in Australia. As the number of Australians aged over 65 years is expected to double to above 25% of the population by 2045, the economic cost and burden placed on the health care system by fragility fractures is also predicted to rise markedly.

As demonstrated by a whole body of evidence, the risk of subsequent fracture once a first osteoporosis fracture has occurred is estimated to increase fourfold. Regardless of the evidence that further fractures may be prevented through increased patient awareness and pharmacological treatment, the prevalence of patient initiated assessment for osteoporosis is low, and many patients who sustain a fracture do not receive any diagnosis, treatment or information regarding osteoporosis. This results in many patients leaving hospital with their fracture treated but their osteoporosis undiagnosed, uninvestigated and untreated. Therefore, re-fracture rates can be reduced by targeting assessment and treatment of patients who have previously sustained fractures. This would subsequently ease the personal, social and economic costs of osteoporosis.

In Australia in 2007, hospitalization for osteoporotic fracture averaged 262 per day, or one person every 5-6 minutes. In light of this, it is clear that to prevent healthcare systems from being overwhelmed by cases of elderly trauma, determined efforts are required to curb the rising prevalence of fragility fracture, particularly at the hip.

Osteoporosis is a chronic disease that many patients endure for several decades, during which time they will suffer several acute fracture events. Unfortunately, osteoporosis often remains undetected and/or untreated until a fracture occurs. Furthermore, in the absence of a systematic approach to delivery of secondary

fracture prevention, the majority of patients presenting with fragility fractures fail to receive treatment to reduce future fracture risk. The effective delivery of secondary preventative intervention when patients first present with fragility fracture, at any skeletal site, provides an opportunity to intervene to minimize the number of future hip fracture cases. Pharmacological intervention at this "signature" fracture stage has the potential to halve future fracture incidence, including hip fractures, during at least three years of treatment, contingent upon compliance with treatment. Thus, in a relatively short time frame, up to one quarter of hip fractures could be averted, in addition to substantial numbers of fractures at other skeletal sites. Economic assessments of health care have demonstrated such intervention to be highly cost-effective.

Mortality and morbidity from fractures

Osteoporotic fractures, commonly of the hip, spine, humerus, forearm and wrist, are typically sustained with little or no preceding trauma. Morbidity from fractures includes pain, deformity, being bed-ridden; reduction in independence and activities of daily living; fear of falling; anxiety; social isolation and emotional disturbances such as depression. Osteoporotic fractures are also associated with excess rates of nursing home admissions and reduced quality of life. Hip fractures can be particularly disabling, with complications that, as with other fractures, can result in death.

All major osteoporotic fractures are associated with the doubling of the age-adjusted mortality rate in women and a threefold increase in men. The probability of death in the first year after a hip fracture is estimated at 10–20%, while approximately half of the survivors are disabled and need help with activities of daily living or require long-term nursing care. The relative risk of mortality is estimated to be 60% higher in women with vertebral fracture than in women without vertebral fracture.

Treatment

Important principles of osteoporosis management are the maximization of bone mass and the prevention (in women) of postmenopausal bone loss. In this respect, the purpose of the pharmacological treatment of osteoporosis is to reduce morbidity and mortality associated with the first and all subsequent fractures.

This type of treatment for osteoporosis is warranted because:

- fractures are associated with significant morbidity and mortality;
- bone loss and fracture risk increase with advancing age; and
- treatments are available to prevent accelerated bone loss, slow the deterioration of the bone's micro architecture and reduce the subsequent risk of fractures.

Conclusion

To minimize the morbidity and mortality associated with fragility fractures, patients suffering minimal trauma fractures require follow-up investigation for osteoporosis after treatment of their fracture.

MEETINGS OF INTEREST

2 Congreso de la Sociedad Espanola de Fracturas Osteoporoticas

Feb 5-7, 2009

Madrid, NH Hotel Eurobuilding

Preliminary program available on our website www.fractures.com

55th Orthopaedic Research Society Annual Meeting

Feb 22-25, 2009

Las Vegas, CA

www.ors.org

AAOS 2009 Annual Meeting

Feb 25-28, 2009

Las Vegas, CA

www.aaos.org

ISFR Spine Workshop

March 13-14, 2009

St. Mary's College, London UK

Ninth European Congress on Clinical and Economic Aspects on Osteoporosis and Osteoarthritis (ECCEO9) –

March 18-21, 2009

Athens, Greece

<http://www.ecceo9.org>

10th European Federation of Orthopaedic & Trauma (EFORT) Congress

June 3-6, 2009

Vienna, Austria

www.efort.org

Canadian Orthopaedic Association 64th Annual Meeting

July 3-6, 2009

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