

2nd Heraeus Ostim Symposium in Berlin

International experts discussed dental bone grafting materials and surgery techniques (bone regeneration in dentistry)

Molecular biological basics of bone formation, osteoinductive effects of the synthetic bone grafting material Ostim® by Heraeus, minimal-invasive sinus lift procedures and socket preservation were the focus topics at the 2nd scientific Ostim Symposium, this time in Berlin. From 4th to 6th September 2008 about 30 experts from 12 countries discussed current studies on the modes of action and applications of the nanocrystalline bone grafting material Ostim by invitation of the dental manufacturer Heraeus.



Attendees of the 2nd Heraeus Ostim Symposium

„Now it's time again for sciences“, chairman Professor Dr Dr Sören Jepsen, director of the Department of Periodontology, Operative and Preventive Dentistry at the University Bonn, opened a vivid exchange of experiences between scientists, practitioners and the manufacturer.

In the previous year, oral surgeons, periodontists and implantologists had already discussed the findings from in vitro, animal and clinical studies on bone grafting in an open atmosphere at the 1st Ostim Symposium in Oxford, Great Britain. Directly compared to other bone grafting materials these studies attest the synthetic Ostim a complete resorption and very good results in the treatment of periodontal, peri-implantitis and craniofacial bone defects as well as in sinus lift and in the

horizontal augmentation for implant preparation. Most of these studies have been published by now. Others are still on-going.

Basic research in bone formation just at the beginning

In 2007, miscellaneous questions concerning the microbiological and molecular processes of bone formation remained open. Yet, the scientific exploration of these fundamental aspects of every augmentation, either with autologous, bovine or synthetic material, is just at its beginning. Dr Fumiyo Ikeda made this clear in one of the first lectures of the symposium in Berlin. At the Institute of Biochemistry II at the Goethe University Frankfurt, she investigates the “signal-induced regulation of bone metabolism”. Thereby, she was able to identify one of the biochemical processes in the formation and differentiation of osteoclasts, including the involved receptors, signal proteins and kinases. If this signaling pathway is being blocked on gene-targeted mice, they show microsomia and osteopetrosis. “For a complete exploration of the osteoblast and osteoclast biology, from cell proliferation over differentiation up to calcification, corresponding testing models have to be worked out first”, Dr Ikeda states.

Nonetheless, for Dr Mehrdad Arjomand the relevance of these findings for the dental future was already obvious: “Couldn't you block the 'signal' for bone resorption in specific situations and thereby inhibit for example peri-implantitis bone defects from the outset?”, the implan-

implantologist and periodontist from Hamburg asked. Ikeda, holding her doctorate in dentistry, answered clearly: “That would be possible. But not yet today.”

Swiss bioreactor for realistic in vitro studies

How biomaterials can be tested in vitro under conditions as similar as possible to natural conditions was illustrated by Professor Dr Ursula Graf-Hausner from the Institute of Chemistry and Biological Chemistry at the Zurich University of Applied Sciences in Wädenswil, Switzerland. For this purpose, she and her team developed a bioreactor which simulates the natural dynamic forces in the living organism: Perfusion, compression and shear forces. “That is because static systems do not tell the whole truth”, Professor Graf-Hausner says. Comparative cultivation tests with human primary fibroblasts for example showed that these proliferated well on a scaffold material under static conditions. Yet, only under biomechanical stimulation in the new reactor they also displayed the desired differentiation and only there they also grew into the scaffold material.

“In dental augmentation we primarily need volume stability. Can this also be tested realistically in your reactor?”, Dr Ralf Smeets, specialist for tissue engineering at the Department of Oral and Maxillofacial Surgery at RWTH Aachen University, asked. “We can set up a mechanical pressure of up to 1.2 bar in the reactor”, Graf-Hausner said. “Insofar we can examine this aspect fairly realistically in vitro as well.” Examinations and tests with Ostim at the Zurich University of Applied Sciences are already being planned.

Studies confirm osteoinductive effects of Ostim

Not with the new reactor, but with other methods Dr Ralf Smeets in vitro examined the bone grafting effects of Ostim and achieved clear results. For the treatment of bigger bony defects he developed a three-dimensional textile carrier composite. Thereon, adult mesenchymal stromal cells (MSCs) were cultivated and osteogenically differentiated in the laboratory. One year ago in Oxford, Dr Smeets had already reported on the good successes

with the addition of Ostim. “We could not explain this, at first”, Dr Smeets said. With the results of immunohistochemical studies he now subsequently provided the explanation in Berlin. Accordingly, the nanocrystalline bone grafting material seems to stimulate the osteogenic differentiation of stem cells. While in the samples with Ostim several markers confirmed this differentiation, in the control group without Ostim no differentiation was detectable. Even in a further control group with only fibrin and Ostim the cells differentiated to bone cells. To none of these groups growth or differentiation factors had been added.

“Therefore, Ostim itself seems to induce the differentiation”, Dr Smeets says. “Thus, our approach offers essential advantages for clinical application.”

Socket preservation with Ostim: Faster healing and better alveolar ridge preservation after extraction

Speakers from Italy and Spain reported on the biostimulating effects of the synthetic bone grafting material, too. After tooth extraction the soft tissue heals faster over alveoli filled with Ostim. In horizontal and vertical dimension less bone is lost.

Professor Dr Marco Mozzati and Dr Valentina Arata presented the corresponding results of a split-mouth study at the University of Turin. On ten patients, each with bilateral tooth extractions, the extraction wounds were treated openly without primary closure prior to the implantation. One alveolus of each patient was filled with Ostim, the other one left empty. “Over the extraction wounds filled with Ostim the soft tissue healed faster and better and sank less into the defect”, Dr Arata reports. “Similarly, the patients’ observations of earlier starting and ending pain and the biomolecular verification of proinflammatory cytokines point to an accelerated healing with Ostim.” Further patients were treated with immediate functional loading. Here as well, the application of Ostim showed good successes.



Dr Rodrigo Martinez (Madrid, Spain) talking to Dr Marianne Countess Schmettow, Product Manager Dental Pharma at Heraeus Kulzer, and Dr Esteban Barragán (Barcelona, Spain)

Dr Esteban Barragán achieved similar results at the International University of Catalonia in Barcelona. There, the socket preserving effects of Ostim were examined in a split-mouth designed study, too, but with primary closure. “In our study the defects treated with Ostim healed faster as well”, Dr Barragán reports. “After four months, the CT scan and panoramic radiographs showed higher bone density and lesser reduction of the alveolar ridge. Thus, in combination with primary closure Ostim is suited very well for socket preservation.”

Minimal-invasive sinus lift with pasty bone grafting material

Due to its pasty consistency Ostim offers completely new possibilities for minimal-invasive surgical techniques in the field of sinus lift. In Berlin, the oral surgeons Dr Michele Lopez (Rome) and Dr Philip Jesch (Vienna) presented two different new methods and instruments. Without further cuts or drillings both raise the Schneiderian membrane directly through the initial drill hole. Thereunder, they place an exactly defined amount of the pasty bone grafting material in a controlled procedure even without direct intervisibility.

Dr Michele Lopez therefore developed a “membrane lift” which he attaches directly to the prefilled Ostim

syringes. With its rounded end he lifts the Schneiderian membrane through the initial drill hole. Through radial slots of the instrument he places the required amount of Ostim exactly where new bone is supposed to give additional stability to the implant. “This new minimal-invasive technique and the controlled application of grafting material through a drill hole of only 3.5 millimeter had become possible only due to the soft consistency of Ostim”, Dr Lopez underlined. “The success rate of implants placed that way is over 95 per cent.”

With a similar technique Dr Philip Jesch from the Zahnambulatorium Wienerberg City scored very good successes, too. To risklessly raise the Schneiderian membrane he uses a “Sinus Lift Pump” developed by Dr Klaus Eder. Using this pump a saline solution is placed under the membrane and is vibrated. Then the membrane is lifted with very little pressure. The amount of the placed saline solution also defines exactly the amount of Ostim which has to be applied subsequently. “This minimal-invasive technique drastically reduces post-operative pain and offers a very fast and good healing”, Dr Jesch stated. “Furthermore, radiograph controls after six months leave no doubt about the good resorption of Ostim and a good bone formation.”

Further research and case studies

Dr Adrian Kasaj, periodontist at the Policlinic for Restorative Dentistry at the Johannes Gutenberg University Mainz, confirmed once more the good results in periodontitis treatment with Ostim, about which he and directors of several studies had reported on the first symposium. According to the 6-month results of a clinical study by Dr Kasaj the additional treatment of intra-osseous defects with Ostim results in significantly improved clinical outcomes compared to traditional open flat debridement alone.

Heraeus recommends the nanocrystalline bone grafting material Ostim mainly for the treatment of small up to midsize bony defects. If certain circumstances or the patient’s wish require it, bigger defects can be

successfully treated with Ostim as well. Oral surgeon Dr Stefan Schermer from Berlin introduced such a case. A female patient with tooth loss and complete atrophy of the alveolar process in the second quadrant asked for an implant-borne replacement for teeth. The thickness of the remaining sinus floor was 1 mm, the Schneiderian membrane got lost due to a former cystectomy. The patient refused a transplantation of autologous bone material. Within a sinus floor augmentation with Ostim and an artificial membrane Dr Schermer succeeded in building up more than 4 ccm of bone material into which he could insert three implants after six months. For a fourth implant further bone material had to be built up. "The pasty, but volume stable consistency of Ostim was a great advantage in this case", Dr Schermer reported.

Critical discussion and demand for further studies

Besides the use of bovine material, the addition of growth and differentiation factors was discussed critically on the symposium.

"Yet, also concerning the use of Ostim alone, there are still too little scientific long-term data available", Dr Maria-Theresia Peters from the German Association of Oral Surgeons encouraged further scientific studies on

the nanocrystalline bone grafting material. Other participants, depending on their personal field of work, asked for further clinical studies or basic research concerning the molecular biological processes of bone formation, either with autologous, bovine or synthetic material.

Good marks the participants consistently assigned to the design of the Symposium and the open discussions between scientists and practitioners from numerous European countries. "Unique platform", "impressive diversity of approaches", "learned many new things" and "interesting exchange of ideas" were among the comments at the final round. But the international exchange of experiences did not end in the conference room. One or the other technical term could be heard as well at the satellite symposium.

And how does the organizer and manufacturer himself evaluate the 2nd Ostim Symposium? "Even though the molecular biological basics and the signaling pathways of bone formation are still not completely explored: It is fascinating to see how we today can support nature to do what only nature can do", Dr Marianne Countess Schmettow, product manager Dental Pharma at Heraeus in Hanau, summed up.