Publications on Tutoplast® Spongiososa
(As of February 2007)
Besides pure cancellous products also cortico-cancellous products are included because their function is essentially based on the cancellous part

Clinic Orthopedics

S-01 Atlihan D et al.
The place of allografts in spinal surgery
Abstract. SICOT, Amsterdam, Netherlands, 1996
Report on 13 patients who had spinal fusion with Tutoplast Spongiososa. Solid fusion was achieved in all.

S-02 Bärlocher CB et al.
Comparative evaluation of microdiscectomy only, autograft fusion, polymethylmethacrylate interposition and threaded titanium cage fusion for treatment of single-level cervical disc disease: a prospective randomised study in 125 patients.
Neurosurgical Focus, 12(1), 2002
In 36 of the 125 patients the cage was filled with Tutoplast Spongiososa. This group had the highest fusion rate.

S-03 Benli IT et al.
Frontal and sagittal balance analysis of late onset idiopathic scoliosis treated with third generation instrumentation.
Kobe Journal of Medical Science, Vol. 47, 2001
Report on 217 patients who had posterior onlay grafting with autogenous or allogenic cancellous bone in addition to internal fixation. 33 patients had Tutoplast Spongiososa. The overall fusion rate was 94.5%.

S-04 Benli IT et al.
Augmentation of third generation instrumentation with sublaminar titanium wiring in late onset idiopathic scoliosis
Kobe Journal of Medical Science, 50(3), 2004
Report on 45 patients who had posterior onlay grafting with a mixture of autologous and allogenic cancellous bone in addition to internal fixation. 13 had Tutoplast Spongiososa. All patients had solid fusion.

S-05 Castenholz HE et al.
First experiences with an especially configurated „Tutogen Dowel“ in autologous osteochondral grafting in the knee joint.
(Erste Erfahrungen mit einem speziell konfigurierten „Tutogen-Dübel“ bei der autologen Knorpel-Knochen-Transplantation am Kniegelenk.)
Abstract. 86. Meeting of the German Society of Orthopaedic Surgeons(DGOT), Wiesbaden, 2000
In 34 patients the harvesting defect of an osteochondral autograft was filled with a press-fit Tutoplast monocortical dowel. Results were compared with other materials. The Tutoplast dowel showed better press-fit and less blood loss.

S-06 Deryabin AV et al.
5-year experience in application of Tutoplast® bioimplants for surgical correction of foot deformations in patients with flabby and spastic paralysis
Abstract. EATB Annual Meeting 2005
In 22 patients 39 feet were treated and grafted with Tutoplast cancellous blocks and chips. All patients had solid bony fusion.
S-O7 Rajan GP et al.
Cancellous allograft versus autologous bone grafting for repair of comminuted distal radius fractures: A prospective, randomized trial.
The Journal of Trauma, 60(6); 2006
90 patients with distal radius fractures were randomly assigned to receive either autograft (n=45) or Tutoplast Spongiosa(n=44). Radiological results were comparable and within normal range. Surgical time was 28 minutes longer on average in the autograft group and after one year 17% of these patients still had loss of sensitivity on the thigh or pain at the harvesting site.

S-O8 Gambini A et al.
Rehabitation of allograft with bone dehydrated with solvents in reconstruction after removal of bone tumors: MRI evaluation
Chir. Organi Mov. LXXIV, 1999
In 15 patients the bony defect after resection of benign or moderately malignant tumors was filled with Tutoplast Spongiosa. In 13 patients the MRI showed complete remodelling after 6 to 13 months while in 2 remodelling was only partial after 6 and 8 months.

S-O9 Helmy N und Hintermann B
New trends in the treatment of proximal humerus fractures
Clinical Orthopaedics and Related Research, 442, 2006
Review of treatment modalities for proximal humerus fractures. The authors recommend defect fill with Tutoplast Spongiosa after repositioning.

S-O10 Hintermann B et al.
Anterior calcaneus elongation osteotomy and medial soft tissue reconstruction for treatment of severe dysfunction of the posterior tibialis tendon
(Anteriore Kalkaneusverlängerung osteotomie und mediale Weichteilerekonstruktion zur Behandlung der schweren Tibialis posterior - Sehnenfunktion. (Article in German, no English translation available.)
Orthopäde, 28(9), 1999
Report on the successful treatment of 16 patients. In 3 Tutoplast Spongiosa was used.

S-O11 Kim YY et al.
Revision arthroplasty using allogenic cancellous chip with HA for pronounced acetabular bone deficiencies
Bioceramics, Vol. 9, 1996
In 100 patients with large bone defects at the acetabulum Tutoplast Spongiosa augmented with hydroxyapatite granules and soaked with autogenous bone marrow was used. All but 3 showed good bony integration and remodelling after one year.

S-O12 Kossmann T et al.
Traumatic paraplegia: surgical principles
(Traumatische Querschnittslähmung: operative Maßnahmen. (Article in German, no English translation available.)
Schweizerische Medizinische Wochenschrift, 130, 2000
Educational article. In the chapter „Materials for spinal fusion“ the authors mention that the have used numerous Tutoplast products, cancellous bone, iliac crest wedges and femoral segments, without any complications.

S-O13 Mastuantuono M et al.
Evaluation of bone allografts with MRI
Abstract. European Congress of Radiology 2001
www.eccr.org/TECR01/scipr01/eshp0776.htm
29 patients with defect fill after tumor resection with Tutoplast Spongiosa were followed with MRI. In 22 the presence of fat marrow in the grafted area demonstrated the completed integration.
S-O14 Mouret P
Statement on the use of Tutoplast processed allogenic cancellous bone
(Gutachterliche Stellungnahme zur Verwendung von Tutoplast konservierter Spongiosa)
Letter to Tutogen dated April 10, 2002 English translation available)
Over a period of roughly 3 years the hospital had sent more than 100 femoral heads for service processing to
Tutogen. The heads were made into chips, blocks and dowels and used for various applications. Good
osseointegration without any signs of rejection was observed.

S-O15 Ozlu S et al.
Radionuclid and histopathological evaluation of combined allograft and autogenous
applications in anterior and posterior spinal fusion
Abstract. The Journal of Turkish Spinal Surgery, 8(1), 1997
In 42 patients a combination of autogenous and Tutoplast spongiosa was used for spinal fusion. After 12 months
x-rays and scintigraphy showed solid fusion in all patients. A comparative histology from 11 of these patients
with 5 with autograft only showed no differences.

S-O16 Rushay A
The conditions of successful plastic of infected defects in long bones by Tutoplast®
bioimplants
Präsentation at the EATB Annual Meeting, 2005
Report on the successful treatment of 12 patients with posttraumatic osteomyelitis. After curettage and antibiotic
treatment the defects were filled with Tutoplast Spongiosa. A good functional result could be obtained in 11
patients.

S-O17 Sesi E und H Özyalcin
The surgical treatment in degenerative spondylolisthesis
Abstract. European Spine Society, Annual Meeting, 1995
18 patients had spinal fusion with iliac crest autografts and 10 with Tutoplast. After 25 months 25 patients had
solid fusion. No differences were found between autograft and Tutoplast.

S-O18 Yue WM et al.
Patellar allografts in anterior cervical fusion – a two-year clinical and radiological study
Singapore Med J, 44(10), 2003
15 patients had cervical spinal fusion with a Tutoplast Patella dowel. Follow-up was 26 to 59 months. 13
patients had fusion within 20 weeks and the remaining two later on.

S-O19 Zhekvakov SV et al.
Tutoplast bone allograft for interbody fusion in degenerative and traumatic instability.
Preliminary experience.
Abstract. Eur Spine J, 11, 2002
14 patients had internal fixation and interbody fusion with Tutoplast iliac crest wedges. Patients had follow-up
examinations at 3, 6 and 12 months. All had solid fusion, in most cases already after 6 months.

S-O20 Lee CJ et al.
The advantages of rectangular titanium cage (RABEA) fusion after anterior cervical
discectomy: comparative study of fibula allograft
J Korean Neurosurg Soc, 36; 2004
38 patients had cervical fusion with Tutoplast Fibula filled with autograft and Tutoplast Spongiosa 6:4 and 36
had a titanium cage filled with autograft and Tutoplast Spongiosa 2:8. Follow-up was 18 months in the cage
group and 28 months in the fibula group. Fusion rate was 95% with cage and 74% with fibula.
Clinic Maxillofacial

S-M1 Aleschenko IE et al.
Tutoplast® bioimplants as a solution of reconstructive problems of bone tissues in stomatology
Abstract. 11th International Conference on Tissue Banking and EATB Annual Meeting, Bratislava, Slovak Republic, 2002
Report on the use of Tutoplast Spongiosa for various applications in the jaws. The authors name Tutoplast optimum osteoconductive.

S-M2 Alexopoulou M et al.
Allogenic bone grafting of small and medium defects of the jaws
28 patients received Tutoplast Spongiosa. After 6 months newly formed, lamellar bone was found. The authors name Tutoplast a helpful, simple and safe alternative to autogenous bone.

S-M3 Block MS und M Degen
Horizontal Ridge augmentation using human mineralized particulate bone: Preliminary results.
Journal of Oral and Maxillofacial Surgery, 62(9), Suppl. 2, 2004
11 patients received Tutoplast Spongiosa placed subperiostally with a minimally invasive technique. After 3 months the grafted area felt “bone hard” and implants could be placed after 4 months.

S-M4 Block MS et al.
Human mineralized bone in extraction sites before implant placement.
JADA, 133, 2002
In 18 patients 22 extraction sockets were filled with Tutoplast Spongiosa. At the time of implant placement after 4 months the graft was largely remodelled into vital, stable bone.

S-M5 From SJ et al.
The use of mineralized allograft for sinus augmentation: An interim histological case report from a prospective clinical study.
Compendium, 26(4), 2005 (CME-article)
In a 80-years old patient a sinus lift was performed with a mixture of 1:9 autogenous bone and Tutoplast Spongiosa. Before implant placement after 9 months a bone core was harvested and histomorphometricaly examined. There were 25.2% new bone. 16.8% residual Tutoplast and the rest was connective tissue.

S-M6 Gapski R et al.
Histologic analyses of human mineralized bone grafting material in sinus elevation procedures: a case series
Int J Periodontics & Restorative dentistry, 26(1); 2006
In 4 patients a sinus lift was performed with Tutoplast Spongiosa. At the time of implant placement after 6-7 months bone cores were harvested and the density of the residual alveolar crest bone and the grafted area were compared. Both were identical.

S-M7 Grecci F et al.
Maxillary sinus bone grafting
In 35 patients a uni- or bilateral sinus lift was performed with Tutoplast Spongiosus. The histological results were encouraging.
S-M8 Grecci F et al.
**Sinus grafting. From autologous bone to biomaterials. Histomorphometric issues**
XI Congresso Nazionale della Societa Italiana di Chirurgia Maxillo-Faciale, 1999
*Report on the results with various materials. A mixture of 1:1 autogenous bone and Tutoplast Spongiosa resulted in better implant stability than autogenous bone alone and in excellent histological results. (Article in Italian, English translation available)*

S-M9 Keith JD
**Localized ridge augmentation with a block allograft followed by secondary implant placement: a case report.**
The International Journal of Periodontics & Restorative Dentistry, 24(1), 2004
*Case report on the use of a cortico-cancellous Tutoplast block for alveolar ridge augmentation. The block was completely integrated and implants could be placed after 4 months.*

S-M10 Keith JD und Gapski R et al.
**Clinical and histological analyses of Puros® cancellous chip allografts in humans.**
Zimmer Dental 2004
*Presentation of 3 cases of the successful use of Tutoplast Spongiosa. Histology after 6 months revealed solid new bone formation. Graft remnants could hardly be differentiated from new bone.*

S-M11 Leonetti JA und R Koup
**Localized maxillary ridge augmentation with a block allograft for dental implant placement: case reports**
Implant Dentistry 12(3), 2003
*In 4 patients an alveolar crest augmentation was performed with a cortico-cancellous Tutoplast block. Implants were placed after 5-6 months. A biopsy after 6 months revealed new bone without graft remnants.*

S-M12 Minichetti JC et al.
**Human histologic analysis of mineralized bone allograft (Puros) placement before implant surgery**
Journal of Oral Implantology, 30(2), 2004
*In a 61-years old patient the extraction socket of a mandibular molar was filled with Tutoplast. Before implant placement after 5 months a bone core was taken. Histology found strong new bone formation in direct contact with graft remnants without any signs of foreign body reactions. Based on these results the authors have used about 280cc Tutoplast Spongiosa successfully.*

S-M13 Minichetti JC et al.
**Three-year analysis of tapered screw-vent implants placed into extraction sockets grafted with mineralized bone allograft**
Journal of Oral Implantology, 21(6), 2005
*313 extraction socket in 134 patients were filled with Tutoplast Spongiosa. A total of 252 implants were successfully placed after 3-6 months. The grafted sites were all hard and could not be penetrated with a curette.*

S-M14 Nousbissi SS et al.
**Clinical, histologic and histomorphometric evaluation of mineralized solvent-dehydrated bone allograft (Puros) in human maxillary sinus grafts**
Journal of Oral Implantology, 31(4), 2005
*Report on 7 patients with sinus lift. 6 had Tutoplast Spongiosa and of them had the contralateral sinus grafted with a 1:1 mixture of BioOss and DBM. Histology after 10 months showed significantly more new bone and graft remodelling in the Tutoplast sites.*
S-M15 Petrunzaro PS
Immediate one-stage implant placement and CAD/CAM abutments for posterior restorations
Pract Proced Aesthet Dent, 15(8), 2003
Case report on the immediate implantation after extraction of 2 molars and grafting with Tutoplast Spongiosa. The graft showed complete remodelling radiologically after 4 months.

S-M16 Petrunzaro PS und A Salomon
Localized ridge augmentation with allogenic block grafts prior to implant placement: case reports and histologic evaluations
Implant Dentistry, 14(2), 2005
3 patients had alveolar ridge augmentation with a Tutoplast cortico-cancellous block. All blocks integrated well and implants were placed after 4 months. Biopsies from 2 patients showed abundant new bone formation.

S-M17 Rocci A und M Martignoni
Local enlargement of the alveolar ridge using a mineralized homologous cortico-cancellous block graft: a clinical case study
Quintessence International 11(12), 1999 (Article in Italian, English translation available)
Case report on the use of a Tutoplast cortico-cancellous block. Implants could be placed after 3 months.

S-M18 Rocci A et al.
Pre-implant ridge reconstruction
II Dentista Moderno, Dezember 2000 (Article in Italian, English translation available)
3 case reports. In 2 patients a Tutoplast cortico-cancellous block and in 1 Tutoplast Spongiosa was used. Healing was uneventful and implants could be placed after 5 months.

S-M19 Rocci A und M Martignoni
Cortical-cancellous blocks in severe atrophy of the anterior maxilla
II Dentista Moderno, März 2001 (Article in Italian, English translation available)
In 5 patients with missing maxillary front teeth and severe atrophy block grafting was performed in 2 with autografts and in 3 with Tutoplast cortico-cancellous blocks. All blocks healed without problems within the same time frame.

S-M20 Semergidis et al.
Allogenic bone grafting of small and medium defects of the jaws
In 36 patients small and medium size bone defects after cyst removal were grafted with Tutoplast Spongiosa. After 6 months lamellar bone was seen especially in the mandible.

S-M21 Sener BC et al.
Use of allogenic bone grafts in onlay and sandwich augmentation techniques
In 9 patients a Tutoplast cancellous block was used for vertical crest augmentation as onlay or sandwich graft. All sandwich grafts healed uneventfully while 2 onlay grafts did not heal and one became infected.

S-M22 Simsek B und S Simsek
Evaluation of success rates of immediate and delayed implants after tooth extraction
Chinese Medical Journal, 116(8), 2003
In 80 patients 234 implants were placed after tooth extraction, 76 of them as immediate implants. Extraction sockets and gaps around implants were grafted with Tutoplast Spongiosa. Success rate with immediate implants was 93.4% and with delayed implants 93.7%.
S-M23 Shin H-I und D-S Sohn
A method of sealing perforated sinus membrane and histologic finding of bone substitutes: a case report
Implant Dentistry, 14(4), 2005
A 43-years-old patient was referred to the authors who had sinus lift with BioOss 8 years earlier. The implant had loosened and was removed by the patient. CT scan revealed a mucocele in the grafted sinus. Histology of the removed BioOss showed poor integration. The patient underwent a bilateral sinus lift with Tutoplast Spongiosa and histology after 9 month showed new trabecular bone.

S-M24 Sudbrink SD
Computer-guided implant placement with immediate provisionalization: a case report
J Oral Maxillofac Surg, 63, 2005
In a 25-years-old patient an extraction socket in the anterior maxilla was filled with Tutoplast Spongiosa. After 4 month an individually fabricated implant could be placed.

Effects of a mineralized human cancellous bone allograft in regeneration of mandibular class II furcation defects.
J Periodontol, 77(3); 2006
In 27 patients furcation defects were randomly treated with a gingiva flap alone, grafted with Tutoplast Spongiosa or grafted with Tutoplast and covered with a collagen membrane. Significant new bone formation was seen in the Tutoplast only group. The membrane had no additional effect.

S-M26 Tiiz HH et al.
Use of spongyous bone chips and fascia temporalis in alveolar bone defects
Turk J Med Sci, 34, 2004
In 80 patients 90 bone defects after cystectomy or apical root resection 30 defects were left empty as controls, 30 were filled with Tutoplast Spongiosa and 30 filled and covered with Tutoplast Fascia temporalis. While the empty defects showed new bone formation after 1 year the grafted sites had healed after 6 months. The authors favour grafting with membrane coverage to prevent particle migration.

S-M27 Vastardis S und RA Yukna
Evaluation of allogenic bone graft substitute for treatment of periodontal osseous defects: 6-months clinical results
Compend Contin Educ Dent, 27(1), 2006
In 9 patients with chronic periodontitis the curetted defect was filled with Tutoplast Spongiosa. After 6 months the probing depth was reduced by 3 mm and bone heights had increased by 2.5 mm.

S-M28 Wang H-L et al.
"PASS" principals for predictable bone regeneration.
Implant Dentistry, 15(1); 2006
The authors present their principal of bone regeneration. In an exemplary case Tutoplast Spongiosa was used.

S-M29 Schau I und M Plöger
Immediate implantation and lateral augmentation with human bone grafting material
(Derföntimplantation und laterale Augmentation mit humanem Knochensatzmaterial)
Dent Implantol, 10(3), 2006 (Article in German. English translation available)
Case report. After extraction of a fractured front tooth an immediate implant was placed and the missing buccal wall was replaced with Tutoplast Spongiosa. After 3 months the graft was well organized.
S-M30 Keith JD et al.
Clinical and histologic evaluation of a mineralized block allograft: Results from the developmental period (2001-2004)
Int J Periodontics Restorative Dent, 26(4), 2006
In 73 patients 82 severe alveolar crest defects were grafted with Tutoplast cortico-cancellous blocks. Irregularities were filled with Tutoplast cancellous chips. Implants were placed after 4-6 months. Follow-up was 23 to 36 months. After 1 year 75 blocks were well integrated. The 7 failures were successfully replaced by new blocks. 57 blocks showed no resorption and in the other ones resorption was minimal with max. 2 mm.

S-M31 Whitesides LM et al.
Sinus floor augmentation using a composite graft of bone morphogenetic protein-2 and allogenic cancellous bone (Puros): case report
J Oral Implantol, 32(5); 2006
In a patient with an edentulous maxilla a bilateral sinus lift was performed with 10 cc Tutoplast Spongiosa mixed with rh-BMP 2. After 8 months a bone core was obtained before implant placement. Total bone volume was 28.6% with 87% vital bone on one side and 53.54% and 82% on the other side.

S-M32 Froum SJ et al.
Comparison of mineralized cancellous bone allograft (Puros) and anorganic bovine bone matrix (BioOss) for sinus augmentation. Histomorphometry at 26 to 32 weeks after grafting
Int J Periodontics Restorative Dent, 26(6); 2006
In 13 patients a bilateral sinus lift was performed with the lateral window technique. One side was grafted with Tutoplast Spongiosa the other with BioOss. During implant placement after 26 to 32 weeks a biopsy was taken via the cranial area of the window. BioOss particles were found unchanged and connected only in some areas by small bridges of new bone. Tutoplast was completely remodelled in most cases and showed a typical trabecular structure.

S-M33 Park S-H, Wang H-L
Management of localized buccal dehiscence defect with allografts and acellular dermal matrix
Int J Periodontics Restorative Dent, 26(6); 2006
In 4 patients 5 implants were placed into single tooth defects and the missing buccal wall was grafted with Tutoplast Spongiosa as the inner layer and Tutoplast cortical chips as the outer one. Grafts were covered with allogenic dermis. After 6 months new, dense bone was found in all cases.

S-M34 Plöger M, Schau I
Alveolar crest augmentation with a monocortical allogenic bone block. Technique and clinical case presentation.
(Kieferkammainfllagen mittels eines monocortikal-spongösen allogenem Knochenblocks. Anwendung und klinische Falldarstellung.)
Implantologie Zeitung, 8; 2006 (Article in German, English translation available)
Explanation of the block grafting principles and presentation of a clinical case.

S-M35 Plöger M, Schau I
Reconstruction of alveolar crest defects with allogenic spongiosa
(Rekonstruktion von Kieferkammdken mittels allgener Spongiosa)
Implantologie Zeitung, 10; 2006 (Article in German, English translation available)
In a 36-year old patient an extraction socket was filled with Tutoplast Spongiosa and covered with a Tutodent Membrane. At reentry after 4 months solid, well bleeding bone was found that could not be differentiated from the surrounding bone.
S-M36 Schau I, Plöger M

Augmentation material for all applications in guided bone regeneration
(Augmentationsmaterial für alle Indikationen für eine gesteuerte Knochenregeneration)
Zahn Prax., 10(1); 2007 (Article in German)

Two case reports with the use of Tutoplast Spongiosa and the Tutodent membrane. At reentry after 3 months solid bone had formed sufficient for stable implantation and immediate implant loading.

S-M37 Annibali S et al.

Histological and histomorphometric finding in sinus lift human graft procedures

In 12 patients a sinus lift was performed with Tutoplast Spongiosa. At reentry after 6 months bone cores were taken. Histology showed abundant new bone formation with the few graft remnants well integrated. The authors rate Tutoplast a reliable alternative to autogenous bone.

Animal Studies

S-A1 Aslan et al.

The effect of hyaluronic acid supplemented bone graft in bone healing: Experimental study in rabbits
Journal Biomaterials Applications, 20(3), 2006-02-22

In 30 rabbits two 30mm defects were created in the tibia. One was filled with Tutoplast Spongiosa alone and to the other hyaluronic acid was added. 10 animals each were sacrificed after 20, 30 and 40 days and the grafted sites examined histologically. The site with hyaluronic acid showed better results.

S-A2 Cetiner S et al.

Long-term results of the application of solvent-dehydrated bone xenograft and dura mater xenograft for the healing of oroantral osseous defects: a pilot experimental study.
Dental Traumatology, 19, 2003

In 5 jug pigs a maxillary molar was extracted and an oral-antral fistula created with a 5mm drill. One animal was left untreated, one received an individually shaped Tutoplast cancellous dowel, one had a Tutoplast Dura placed apically and then the defect filled with Tutoplast chips, one had the apical dura only and one had the dura apically and coronally. Animals were sacrificed after 6 months. The defects grafted with bone showed the strongest new bone formation.

S-A3 Dalkyz m et al.

Evaluation of the effects of different biomaterials on bone defects.
Implant Dentistry, 9(3), 2000

In 30 rabbits 5 bone defects were created in the tibia. One was left empty and the others were filled with 4 different bone grafting materials, among them Tutoplast Spongiosa. 5 animals each were sacrificed after 7, 15, 30, 45 and 60 days. Tutoplast and calcium hydroxide were the most effective materials in terms of new bone formation and remodelling.

S-A4 Dayi E et al.

The effects of bone chips dehydrated with solvent on healing bone defects
The Journal of International Medical Research, 30, 2002

In 30 rabbits two 30mm defects were created in the right tibia. One was left empty and the other was filled with Tutoplast Spongiosa. Animals were sacrificed after 10, 20 and 30 days. On day 10 bone formation was better in the grafted defect with no difference afterwards.
S-A5 Günther KP et al.
Osseointegration of solvent-preserved bone grafts in an animal model
(Osteointegration lösungsmittelkonservierter Knochentransplantate im Tiermodell)
Osteologie 5(1), 1996 (Article in German, English translation available)
Cylinders of fresh - frozen rabbit bone and Tutoplast processed human and bovine bone were implanted press-fit into critical size defects in the femoral condyles of rabbits. All three materials were completely replaced by new bone within the same time frame.

S-A6 Günther KP et al.
Solvent-preserved spongiosa as bone graft – experimental evaluation in different animal models
(Lösungsmittelkonservierte Spongiosa als Knochentransplantat-experimentelle Untersuchungen in unterschiedlichen Tiermodellen.)
Abstract. In: Haas NP und Stümer KM(Hrsg) 64. Jahrestagung der Deutschen Gesellschaft für Unfallchirurgie e. V., Springer Verlag, 2000 (Article in German)
Tutoplast Spongiosa was tested in rabbits and sheep. While in rabbits complete remodelling was seen within 6-12 months, graft remnants were still present after 9 months in sheep.

S-A7 Kessler S et al.
Solvent dehydrated bone transplants to bridge segmental bone defects: histomorphological and biomechanical investigations in an animal model.
Arch Orthop Trauma Surg, 121, 2001
Wedge-shaped defects were created in the tibial head in 12 merino sheep and filled with a Tutoplast Spongiosa wedge. Animals were sacrificed after 9 months. Histology showed new bone laid down on the graft trabeculae resulting in higher density compared to normal bone.

S-A8 Kessler S et al.
Bone morphogenetic protein 2 accelerates osteointegration and remodelling of solvent-dehydrated bone substitutes
Arch Orthop Trauma Surg, 124, 2004
Same study protocol as in S-T7 but the Tutoplast wedges were soaked with rh-BMP-2. Animals were sacrificed after 4 weeks and 9 months. After 4 weeks remodelling was more progressed than in the previous study but bone density and compression strength were comparable.

S-A9 Merten H-A et al.
Evaluation of augmentation materials in oral surgery – an animal experimental-histomorphometric comparison
(Evaluation oralchirurgischer Augmentationsmaterialien – ein tierexperimentell-histomorphologischer Vergleich)
Implantologie, 11(3), 2003 (Article in German)
In the mandibles of minipigs standardized critical size defects were created and filled with various bone grafts, among them Tutoplast Spongiosa. Tutoplast showed an initial foreign body reaction but was completely absorbed and replaced by new bone after 28 weeks.

S-A10 Thorwarth M et al.
Bony repair of osseous defects
(Knöcherne Reparation ossärer Defekte)
ZWR, 113(9), 2004 (Article in German)
In the frontal bone of adult pigs 4 defects each of 1cm diameter and 1cm depth were created. One was left empty, one was filled with autogenous bone, one with Tutoplast Spongiosa and one with Tutoplast bovine spongiosa. Animals were sacrificed after 1, 8 and 12 weeks. All grafting materials showed the same healing pattern.
Laboratory Studies

S-L1 Endres S et al.
Biocompatibility testing of differently sterilized and disinfected allogenic bone grafts in comparison to the Gold Standard autogenous bone – an in-vitro analysis of immune modulation
(Biokompatibilitätsstestung unterschiedlich sterilisierer bzw. desinfizierter allogener knochentransplantate im Vergleich zum Goldstandard der autologen Knochenspende-eine „In-vitro“-Analyse der Immunmodulation.)
Zeitschrift für Orthopädie und ihre Grenzgebiete, 143, 2005 (Article in German)
Slices of differently treated human cancellous bone, among them Tutoplast Spongiosa, were tested in cultures of human osteoblasts. Growth and metabolism on Tutoplast was only slightly different from controls.

S-L2 Günther K et al.
In-vitro toxicity testing of bioceramics and bone grafts in fibroblast culture
(In-vitro-Toxizitätstestung von Biokomponenten und Knochentransplantaten in der Fibroblastenkultur.)
Biomedizinische Technik, 38(10), 1993 (Article in German)
Various bone substitutes, among them Tutoplast Spongiosa were tested in fibroblast cultures for cytotoxicity.
Tutoplast showed the same low cytotoxicity as inert ceramics.

S-L3 Mayr-Wohlhart u et al.
Proliferation and differentiation rates of a human osteoblast-like cell line (SaOS-2) in contact with different bone substitute materials
Various bone grafting materials, among them Tutoplast Spongiosa were tested in a cell culture. Results were comparable for all materials.

S-L4 Thull R et al.
Mechanical properties of native and processed spongiosa
(Mechanische Eigenschaften nativer und präparierter Spongiosa)
In: Pesch H-J et al.(Hrsg.) Osteologie aktuell VII, Springer Verlag, 1993 (Article in German, English translation available)
Native and Tutoplast processed human spongiosa were tested for compression strength and E-modulus. Neither the process itself nor the final irradiation with up to 25 kGy caused a change in biomechanical properties.

S-L5 Trenz OM et al.
Osteoblast proliferation on preserved bovine and human spongiosa
Osteoblastenproliferation auf konservierter boviner und humaner Spongiosa
Tutoplast Spongiosa and BioOss were tested in a culture of human osteoblasts. Cells showed significantly better proliferation and metabolism on Tutoplast.

S-L6 Trentz OA et al.
Osteoblast response to allogenic and xenogeneic solvent dehydrated cancellous bone in vitro
Biomaterials, 24, 2003
Tutoplast Spongiosa and Tutobone were tested in a culture of human osteoblasts. No differences were found in cell proliferation and adhesion. Osteocalcin production on Tutoplast was significantly lower than in controls only on day 3.
S-L7 Ziegler J et al.

Adsorption and release properties of growth factors from biodegradable implants

Various bone replacement materials, among them Tutoplast Spongiosa, were tested for adsorption and release of various growth factors. Tutoplast showed the lowest adsorption and fastest release.