4th Annual Conference and Expo on **Biomaterials**

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Scientific Tracks & Abstracts

Day 1

Biomaterials 2019

SESSIONS

Advanced Bio Materials| Bio Nano materials | Polymer Biomaterials

Chair: Mehmet Bayrak, Ortadogu Private Hospital, Turkey
Co-Chair: P V Rao, IIT Delhi, India

SESSION INTRODUCTION

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Liana Azizova, University of Brighton, UK

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Title: New biobased building blocks for health sciences and biomaterials
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Liana Azizova et al., J Biotechnol Biomater 2019, Volume 9
DOI: 10.4172/2155-952X-C1-112

Argatroban immobilization on Cu-modified PVC and PU

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[1]University of Brighton, UK
[2]Palladin Institute of Biochemistry of the National Academy of Sciences of Ukraine, Ukraine

Thrombosis induced by biomaterials after their contact with blood is a main reason of medical device failure. To make material surface more thromboresistant different approaches have been undertaken. NO generating biomaterial has proven to play a crucial role in the prevention of thrombosis by inhibiting the platelets activation/adhesion. However, immobilization of the direct thrombin inhibitors onto material surface makes material more thromboresistant by preventing thrombin-mediated blood clotting. The aim of this research was to immobilize argatroban a direct thrombin inhibitor with reliable and predictable anticoagulant effect onto PVC and PU polymers. Both polymers were first imprinted with Cu ions for the catalytic generation of NO (this research was reported earlier). Argatroban was immobilized on the Cu-modified PVC and PU using the polydopamine ad-layer via the Michael addition/Schiff base reaction. The amount of argatroban bound to the polymer surface was measured (spectrophotometric determination at 334 nm) as 11.92 nmol/cm^2 on PVC and 13.10 nmol/cm^2 on PU surface. Assay using thrombin-specific chromogenic substrate was performed to evaluate the thrombin inhibition capacity of argatroban-modified polymers. It was found that both Argatroban-modified polymers inhibit thrombin activity in PBS. In order to confirm the NO generation catalyzed by Cu/Arg-modified PVC and PU samples after incubation with 100 μM GSNO/GSH in the PBS during 1h was examined using ArrowSTRAIGHT™ nitric oxide measurement system (Lazar Research Laboratories, Los Angeles, CA, USA). The Cu/Arg-modified PVC and PU generate NO with the rate 1.27-1.66×10^{10} mole/cm^2·min which is within the physiological level. From the data obtained it's possible to conclude, that immobilization of Argatroban to the Cu-modified polymers showed combine abilities: i) generate NO caused by Cu ions and ii) have capacity to inhibit thrombin formed in the blood via surface immobilized argatroban.

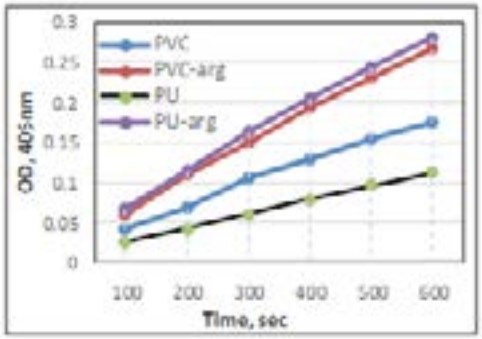

Figure 1: Generation of pNa from chromogenic substrate S2238 by 0.4 NIH/ml of thrombin that was pre-incubated with PU or PU modified with Argatroban during 20 min. The remnant thrombin activity is being measured.

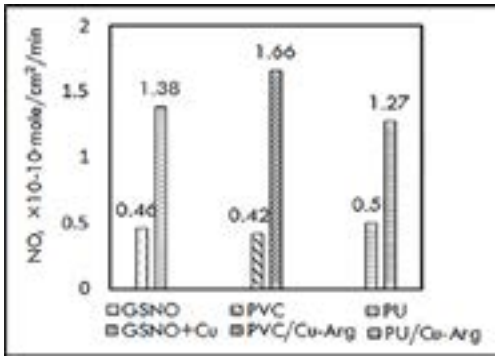

Figure 2: NO generation after incubation of Cu/Arg-modified PVC and PU with 100 μM GSNO/GSH in the PBS during 1h.

Recent Publications

1. K Kulyk, B Palianytsia, J D Alexander, L Azizova, M Borysenko, M Kartel, M Larsson and T Kulik (2017) Kinetics of valeric acid ketonization and ketenization in catalytic pyrolysis on nanosized SiO_2, γ-Al_2O_3, CeO_2/SiO_2, Al_2O_3/SiO_2 and TiO_2/SiO_2. ChemPhysChem 18:1943.
2. L R Azizova, T V Kulik, B B Palianytsia and N A Lipkovska (2015) Thermal and hydrolytic stability of grafted ester groups of carboxylic acids on the silica surface. J Therm. Anal. Calorim 122:517.
3. Liana Azizova, Tetiana V Kulik, Borys B Palianytsia, Aleksandr E Zemlyakov, Viktoriya N Tsikalova and Vasiliy Ya Chirva (2005) Investigation of chemical transformations of thiophenylglycoside of muramyl dipeptide on the fumed silica surface using TPD-MS, FTIR spectroscopy and ES IT MS. Nanoscale Research Letters 9:234.
4. T V Kulik, L R Azizova, B B Palyanytsya, A E Zemlyakov and V N Tsikalova (2010) Mass spectrometric investigation of synthetic glycoside of muramyl dipeptide immobilized on fumed silica surface. Mater Sci Eng B. 169:114.
5. A E Zemlyakov, V N Tsikalova, L R Azizova, V Ya Chirva, E L Mulik, M V Shkalev, O V Kalyuzhin and M V Kiselevsky (2008) Synthesis and Biological Activity of Aryl S-β-Glycosides of 1-Thio-N-Acetylmuramyl-L-Alanyl-D-isoglutamine. Russ. J. Bioorg. Chem. 34:223.

Biography

Liana Azizova received her Master degree at Taurida National V.I. Vernadsky University in 2005. She got PhD in Surface Chemistry in 2013. She has her expertise in the area of surface chemistry, surface characterization, catalytic reactions on the surface of inorganic oxides, their kinetics and mechanisms and synthesis of hybrid organic-inorganic nanocomposites. It includes the development of biocompatible coating materials and composites for biomedical application. In particular, modification of polymer and nanosized oxides surfaces by biologically active compounds and biopolymers (polysaccharides, glycopeptides, carboxylic acids), adsorption and determination of a structure of an adsorption layer of biomolecules on a surface of inorganic oxides. Also, she dealt with heterogeneous catalytic reactions on the surface of inorganic oxides, their kinetics and mechanisms. Another area of her activity is mass spectrometric investigation of biomolecules interaction with inorganic oxide surfaces and thermal transformations of biomolecules on inorganic oxide surfaces using thermal analysis.

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Notes:

Chara Simitzi et al., J Biotechnol Biomater 2019, Volume 9
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Biodegradable microparticles with hierarchical topographical features influence mesenchymal stem cell behaviour

Chara Simitzi and **Richard Day**
UCL, UK

Statement of the Problem: Mesenchymal stem cells (MSCs) are becoming increasingly important due to the broad spectrum of trophic and immunomodulatory factors they secrete. The MSC secretome plays a role in angiogenesis and revascularization, immune modulation and tissue repair; however, there is a lack of methods suitable for controlling this effect. Evidence exists to show cell substrates influence MSC behaviour. Therefore, manipulating the cell substrate could provide improved methods for controlling the secretome for new therapies but there is currently a lack of cell substrates suitable for implantation.

Methodology & Theoretical Orientation: The effect of implantable substrates consisting of biodegradable microparticles with hierarchical topographical features was investigated on MSC behaviour and secretome. Poly(DL-lactide-co-glycolide) microparticles were fabricated via the thermally-induced phase separation technique (TIPS). Three different polymer compositions of lactide/glycolide were studied. Microparticles were characterized in terms of surface topography and porosity. Human adipose-derived MSCs (ADMSCs) were attached to the surface of the microparticles and cultured for 16 days in xeno-free medium. Cell growth on the microparticles was evaluated at different time-points and compared with cells cultured on tissue culture plastic. The angiogenic activity of the ADMSC secretome was evaluated by ELISA and *in vitro* angiogenesis assays.

Findings: Three different types of TIPS microparticles with different morphological and physicochemical characteristics were investigated. ADMSCs adhered and proliferated on all types of the microparticles. Vascular endothelial growth factor (VEGF) secretion was increased from cells cultured on the microparticles compared with cells cultured on tissue culture plastic. MSCs attached to microparticles remained viable after 16 days, were capable of migrating from the microparticles, and retained their lineage plasticity.

Conclusion & Significance: Our results show that attaching MSCs to biodegradable TIPS microparticles can influence their growth and secretion of pro-angiogenic growth factor. This finding may provide a new method for regenerative medicine.

Recent Publications

1. Vizoso F et al. (2017) Mesenchymal stem cell secretome: towards cell-free therapeutic strategies in regenerative medicine. Int. J. Mol. Sci. 18(9):1852.
2. Tran C and Damaser M S (2015) Stem cells as drug delivery methods: application of stem cell secretome for regeneration. Adv. Drug Deliv. Rev. 82-83:1-11.
3. Anderson H J et al. (2016) Mesenchymal stem cell fate: applying biomaterials for control of stem cell behavior. Front. Bioeng. Biotechnol. 4:38.
4. Blaker J, Knowles J and Day R M (2008) Novel fabrication techniques to produce microspheres by thermally induced phase separation for tissue engineering and drug delivery. Acta Biomaterialia 4(2):264-272.
5. Parmar N, Ahmadi R and Day R M (2015) A novel method for differentiation of human mesenchymal stem cells into smooth muscle-like cells on clinically deliverable thermally induced phase separation microspheres. Tissue Eng. Part C Methods 21(4):404-412.

Biography

Chara Simitzi graduated as a Chemical Engineer from the National Technical University of Athens (Greece) and then continued her studies in biomedical and tissue engineering. She pursued her MSc in Biomedical Engineering from RWTH Aachen University (Germany); PhD in Biology from University of Crete (Greece). After her PhD she worked at the Foundation for Research and Technology - Hellas Institute in Crete and the Queen Mary University of London (UK) respectively. She is currently a Postdoctoral Research Associate in the group of Professor Day (Applied Biomedical Engineering group) at the University College London. Her scientific interests focus on the cell-biomaterial interface and more specifically on the development of novel types of scaffolds for tissue engineering applications and cell culture platforms for in vitro studies to address cell biology questions.

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Notes:

P.V. Rao et al., J Biotechnol Biomater 2019, Volume 9
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Experimental investigation of microtopography patterns on bacterial attachment

P.V. Rao, Deepak Patil, S Aravindan and **Vivekanandan P**
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Statement of the Problem: The adhesion of bacterial cells on any surface is the first step of biofilm formation. Biomedical field is more concern about biofilm formation as medical devices get frequently contaminated with bacteria and leading to the formation of mature biofilm which can put patient lives at risk. Researchers have reported that the surface topography with micro patterns affects the initial adhesion of bacterial cells. However, the effect of the number of corners on the behavior of bacterial cells is yet to be investigated. In this work, the different types of microscale geometrical features (Triangle, Square, Star pattern with four and five corners) are fabricated on polydimethylsiloxane (PDMS) using soft lithography technique (Fig. 1). Through static droplet contact angle analysis, it is confirmed that the fabricated micro patterns alter the wettability of plain PDMS surface. The effect of number of corners on the migration and initial attachment of *Escherichia coli (E. coli)* and *Staphylococcus aureus (S. aureus)* are investigated using fluorescence microscopy. The adhesion of bacterium depends on the number of corners present in the geometrical feature. Moreover, the bacterial adhesion is correlated with the ratio of pillar cross-sectional area to its perimeter (λ). The experimental investigation can be useful in designing the effective geometry which can be used in making anti-biofouling structured polymeric devices for biomedical applications.

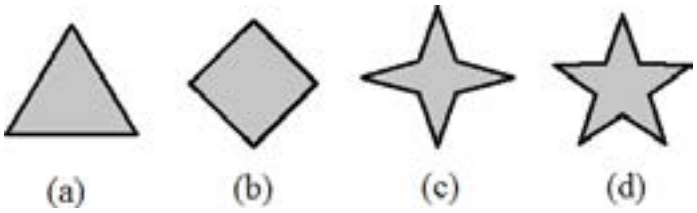

Figure 1: Different types of micropatterns tested against E. coli and S. aureus (a)Triangle (b) Square (c) Star with four corners (d) Star structures with five corners

Recent Publications

1. Helbig R, Günther D, Friedrichs J, Rößler F, Lasagnib A, Werner C (2016) The impact of structure dimensions on initial bacterial adhesion. RSC Biomaterials Science 4:1074–1078.
2. Vasudevan R, Kennedy AJ, Merritt M, Crocker FH, Baney RH (2014) Microscale patterned surfaces reduce bacterial fouling- microscopic and theoretical analysis. Colloids and Surfaces B 117:225–232.
3. Glinel K, Thebault P, Humblot V, Pradier CM, Jouenne T (2012) Antibacterial surfaces developed from bio-inspired approaches. Acta Biomaterials. 8: 1670–1684.
4. Yifu D, Sajjad M, Masoud A, Alan RG (2017) Surface patterning of polymeric membranes and its effect on antifouling characteristics. Separation Science and Technology, 52:240-257.
5. Naiyan L, Wei ., Yuyan W, Xiaoxia C, Yao C, Peng Z (2016) Fabrication of PDMS surfaces with micro patterns and the effect of pattern sizes on bacteria adhesion. Food Control 68:344-351.

Biography

Dr. Venkateswara Rao Paruchuri is currently a Professor & Head, Department of Mechanical Engineering, Indian Institute of Technology Delhi. He received Masters & Doctorate Degrees from Indian Institute of Technology Madras. Prior to that, he obtained Bachelor's Degree from Regional Engineering College Warangal. He has been faculty at IIT Delhi since 1996. His research interests include Material Removal Processing, Micro/Nano Manufacturing, and Sustainable Machining. He received BOYSCAST fellowship award from Government of India in 1998. He was a visiting Assistant Professor at Oklahoma State University, USA in 1999. He was visiting Professor at Tokyo Institute of Technology, Japan in 2012. He published more than 193 research papers in National and International Journals and Conferences. He supervised 21 Ph.D. and several M.Tech theses. He is also a member of Editorial Board of International Journal of Industrial Engineering: Theory, Applications & Practice. He has undertaken several sponsored research projects as Principal Investigator.

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Sudarsan Ghosh et al., J Biotechnol Biomater 2019, Volume 9
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An approach towards improvement of machinability of metallic bio materials

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With the invention of new technologies and development of the new materials, wide ranges of materials are made available for their usage in medical applications. These materials are referred as biomaterials, among which the metallic biomaterials have become an intensive source of interest for the researchers, doctors and surgeons owing to its costs and highly impressive properties. The metallic biomaterials play a predominant role in dental and orthopedic fields as a structural biomaterial in surgeries. Among all the metallic biomaterials Co-based alloys, Ni-based alloys and Ti-based alloys are gaining more popularity owing to their high mechanical strength and fracture toughness. However, utilizing these materials require high degree of machining. In the current study, an effort has been made towards improving the machinability of Ni-based alloy without making use of any coolant or lubricant during the machining operation keeping in mind the aspect of sustainability. The machinability of the alloy is improved by altering the cutting tool properties and conditions by making use of the mechanical treatment technique i.e. micro abrasive blasting. The process improves the cutting tool performance by altering its surface and sub-surface properties thereby improving the characteristics of machined surface. Dry machining of these metallic biomaterials with the use of altered tools is not only an effort towards sustainability but also helps in reducing any type of reactive action between the two.

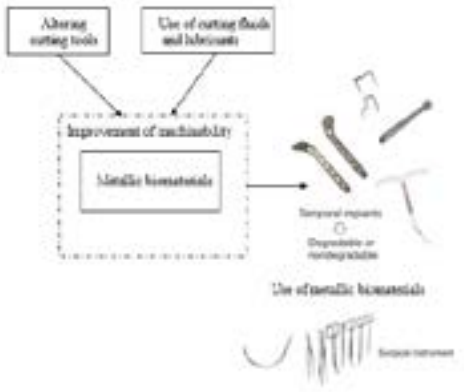

Figure1: Outputs of improving machinability of metallic biomaterials using alternative means.

Recent Publications

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2. Dahotre S N, Vora H D, Pavani K et al (2013) An integrated experimental and computational approach to laser surface nitriding of Ti–6Al–4V. Applied Surface Science 271:141–148.
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4. Resendiz J, Egberts P and Park S S (2018) Tribological Behavior of multi-scaled patterned surfaces machined through inclined end milling and micro shot blasting. Tribology Letters 66:132.

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Indrani Mishra, J Biotechnol Biomater 2019, Volume 9
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Effect of self-affine morphology of natively oxidized Silicon (100) on wetting, scaling properties and DNA fractal dimension

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Indian Institute of Technology Delhi, India

Experimental results on the behavior of wetting on self-affine surfaces of natively oxidized Silicon (100) are presented. The self-affine surfaces have been prepared by the technique of ion irradiation. These surfaces, as results show, present hierarchical multi-scale rough morphologies, not observed earlier for hydrophilic surfaces. They further demonstrate a wetting behavior which depends on the fractal dimension of the surface after irradiation. Results show that structural properties and fractal dimension of DNA molecules, immobilized on the self-affine surfaces, are effected by the fractal dimension and morphology of the surfaces prior to immobilization. The surfaces are self-affine in nature and show hydrophilic behavior. The results presented here show that these surfaces exhibit multi- scale roughness with hierarchical structures. The wetting behavior of water droplets shows a dependence on the fractal dimension of the surface after irradiation. Results on the Si/SiO x surfaces, after DNA immobilization, are also presented. The surfaces do not demonstrate any hierarchical roughness after immobilization and rather exhibit two dimensional flat-smooth morphology. Modifications in the fractal dimension of DNA on these surfaces are also explored. Present studies can have technological implications for many bio-applications.

Recent Publications

1. Interactions of DNA molecule with oxide nano structures. I Mishra, S Majumder, A Manna, S Varma AIP Conference Proceedings 2005 (1), 020010 (2018)
2. Formation of Anisotropic Nanostructures on Rutile TiO_2(110) Surfaces and Their Photo-Absorption Properties. V Solanki, SR Joshi, I Mishra, D Kanjilal, S Varma Metallurgical and Materials Transactions A 49 (7), 3117-3121 (2018)
3. Optical studies of cobalt implanted rutile TiO2 (110) surfaces. SR Joshi, B Padmanabhan, A Chanda, I Mishra, VK Malik, NC Mishra, ... Applied Surface Science 387, 9
4. Oxygen vacancy mediated enhanced photo-absorption from ZnO (0001) nanostructures fabricated by atom beam sputtering. V Solanki, SR Joshi, I Mishra, D Kabiraj, NC Mishra, DK Avasthi, S Varma Journal of Applied Physics 120 (5), 054303 (2016) 38-943 (2016)

Biography

Indrani Mishra have worked on various techniques like ion irradiation, UV irradiation and plasma etching to modify surfaces of SiOx, TiO2 and PDMS in order to enhance its properties for application as biosurfaces and biosensors. The modified surfaces were interacted with plasmid and branched DNA, also interaction of fibroblast cells with plasma modified surfaces has been studied. She has been working with X-Ray Photoelectron Spectroscopy (VG SYSTEM) and Multimode Atomic force Microscopy (from Bruker with a Nanoscope V controller). She has experience of operation and data analysis of XPS and AFM and contact angle measurements. Apart from this she is acquainted with operation and data analysis of Raman, UV visible, pl and XRD systems. She wish to explore the interaction of biomolecules with nanoporous materials, as these materials due to their large surface area, controlled pore size distribution, controllable pore structure and versatile composition has attracted increasing applications in bioengineering, catalysis and biosensing area.

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Robert Lazeroms, J Biotechnol Biomater 2019, Volume 9
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New biobased building blocks for health sciences and biomaterials

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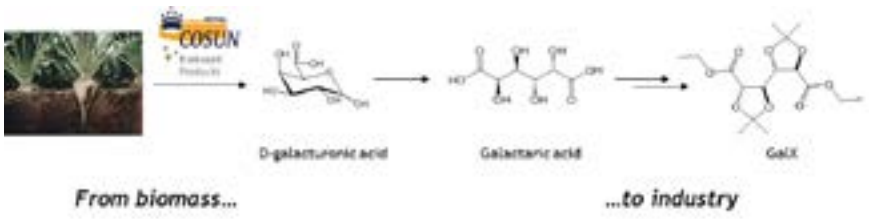
Cosun biobased products (CBP) offers biobased solutions. The activities range from development to manufacturing and supply of biobased functional chemicals. Within Cosun R&D and CBP, we have developed a biorefinery concept on sugar beet pulp. Within this flexible concept, we are able to isolate cellulosic fibers, and different monosaccharides. One of the key monosaccharides is D-galacturonic acid. Using mild processing conditions, galacturonic acid can be isolated and selectively oxidized to galactaric acid (commercial name: mucic acid). This molecule has multiple outlets including health sciences. It offers unique functionalities, which are already used in pharmaceutical applications (for example isometheptene mucate). For higher volume outlets, biomaterials can be made using galactaric acid as an intermediate to GalX. This novel platform building block shows new opportunities to polymers and crosslinkers. In shared research with universities, GalX shows good Mw, Tg and E modulus compared to industrial benchmarks. Besides these parameters, the improved water solubility compared to adipic acid is an unmet market need for new formulations.



Recent Publications

1. Gavrila I, Raffa P and Picchioni F (2018) Acetalised galactarate polyesters: interplay between chemical structure and polymerisation kinetics. Polymers (Basel) 10(3):248–267.
2. Wróblewska A, Bernaerts K and De Wildeman S (2017) Rigid, bio-based polyamides from galactaric acid derivatives with elevated glass transition temperatures and their characterization. Polymer (Guildf) 124:252–262.
3. Van der Klis F, Gootjes L, Van Haveren J, Van Es D and Bitter H (2018) From batch to continuous: Au-catalysed oxidation of D-galacturonic acid in a packed bed plug flow reactor under alkaline conditions. Reaction Chemistry & Engineering 3:540–549.
4. Wróblewska A, Bernaerts K and De Wildeman S (2018) In-depth study of the synthesis of polyanalysis in the melt using biacetal derivatives of galactaric acid. Polymer degradation and stability 151:114–125.

Biography

Robert Lazeroms is a Specialist in Organic Chemistry. During his industrial career, he worked within the medicinal chemistry department (2000 - 2008) of Organon in Oss, where innovative chemistry is key issue to develop new medicines. From 2008 – 2012, he worked within Organon/Merck MSD within the active pharmaceutical ingredient (API) department, in the field of troubleshooting related to the production activities of API's. In 2012, he started as a Technical Project Leader within Royal Cosun to set up R&D activities for the valorization of galacturonic acid from sugar beet pulp. Besides his work at Cosun, he is a part time researcher of the Avans Biopolymer group in Breda.

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Mehmet Bayrak et al., J Biotechnol Biomater 2019, Volume 9
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Permacol ™ collagen paste injection in anal fistula treatment: Retrospective study with eighteen months follow-up

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Introduction: This study aimed to evaluate the applicability, safety, results, and functional performance of Permacol™ collagen paste injection in patients with an anal fistula.

Methods: Thirty-nine patients with anal fistula underwent Permacol™ collagen paste injection between February 2015 and February 2018. The patients were followed up for a total of 18months with intervals of 3, 6, 12 and 18 month recovery conditions monitored. Fifteen patients for a period of 6–8 weeks and two patients for a period of 12 weeks underwent preoperative insertion of seton.

Results: A transsphincteric anal fistula was present in 20 patients, and an intersphincteric fistula was present in 11 patients. There was a recurrence in 7 patients (17.9%): 1 patient (2.5%) after 1-month follow-up, 3 patients (7.6%) after 3-month follow-up, 2 patients (5.1%) after 6-month follow-up, and 1 patient (2.5%) after 18-month follow-up. A complete recovery was observed in 32(82.0%) patients after a 18-month follow-up. The mean Fecal Incontinence Severity Index (FISI) score was 0.29±0.64 preoperatively and 0.55±1.03 after 12 months.

Conclusion: In this study, we show that Permacol™ is a safe and successful method that does not compromise continence following injection and treatment of patients with an anal fistula.

Recent Publications

1. Panés J, García-Olmo D, Van Assche G, Colombel JF, Reinisch W, Baumgart DC, Dignass A, Nachury M, Ferrante M, Kazemi-Shirazi L, Grimaud JC, de la Portilla F, Goldin E, Richard MP, Diez MC, Tagarro I, Leselbaum A, Danese S; ADMIRE CD Study Group Collaborators. Long-term Efficacy and Safety of Stem Cell Therapy (Cx601) for Complex Perianal Fistulas in Patients With Crohn's Disease. Gastroenterology. 2018 Apr;154(5):1334-1342.
2. Haim N, Neufeld D, Ziv Y, Tulchinsky H, Koller M, Khaikin M, et al., Long-term results of fibrin glue treatment for cryptogenic perianal fistulas: a multicenter study. Dis Colon Rectum. 2011;54(10):1279-83.
3. Fabiani B, Menconi C, Martellucci J, Giani I, Toniolo G, and Naldini G, Permacol collagen paste injection for the treatment of complex anal fistula: 1-year follow-up. Tech Coloproctol. 2017;21(3):211-215.
4. Giordano P, Sileri P, Buntzen S, Stuto A, Nunoo-Mensah J, Lenisa L, et al., Final results of a European, multi-centre, prospective, observational Study of Permacol() collagen paste injection for the treatment of anal fistula. Colorectal Dis. 2017. May 11. doi: 10.1111/codi.13715. [Epub ahead of print] PubMed PMID: 28493393
5. Giordano P, Sileri P, Buntzen S, Stuto A, Nunoo-Mensah J, Lenisa L, et al., A prospective multicentre observational study of Permacol collagen paste for anorectal fistula: preliminary results. Colorectal Dis. 2016;18(3):286-94.

Biography

Mehmet Bayrak and Yasemin Altıntas have expertise in evaluation and passion in improving the health and wellbeing. Their open and contextual evaluation model based on responsive constructivists creates new pathways for improving healthcare. They have built this treatment model after years of experience in research, evaluation, teaching and administration both in hospital and education institutions. This approach is responsive to all stakeholders and has a different way of focusing.

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Sutipat Pairojboriboon et al., J Biotechnol Biomater 2019, Volume 9
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Used of 3D printing technology in orthopedic oncology: Custom surgical guide and patient-matched prosthesis

Sutipat Pairojboriboon[1], **Peter C Liacouras**[2,3], **Suriya Luenam**[1] and **Thipachart Punyaratabandhu**[1]
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[2]Walter Reed National Military Medical Center, Bethesda, USA
[3]Uniformed Services University of the Health Sciences, USA

Statement of the Problem: Presenting the clinical outcome of patient-matched prosthesis and custom surgical guide via 3D printing technology.

Methodology & Theoretical Orientation: Total 11 cases of benign and malignant tumors applying 3D printing assisted surgery which are 6 anatomical models, 11 custom surgical guides, and 4 patient-matched prostheses. Image acquisition was derived from CT scan, 0.5-3 mm slices cut. The contralateral CT scan was used as a prototype for creating the patient-matched prosthesis while the ipsilateral CT scan was used in anatomical model and surgical cutting guide. Anatomical models, used as the preoperative planning tools, were printed by a fused deposition modeling (FDM) printer with acrylonitrile butadiene styrene (ABS) material and a Binder Jetting machine, 3D Systems ZPrinter 650 using VisiJet PXL materials. 11 custom surgical guides were printed by Envision TEC's E-Guide Tint and E-Model. 4 of patient-matched prostheses, which are 2 fingers prostheses, 1 of total constrained proximal interphalangeal (PIP) joint prosthesis, and 1 of navicular 3D custom scaffold, were printed by selective laser-melted (SLM) printer with Ti6Al4V. The pore geometry selective laser-melted Ti6Al4V bone scaffolds was 200 μm, strut size and 500 μm, pore size. Time to produce was 3-20 days. Preoperative planning via anatomical model showed better outcomes in term of decrease operative time and blood loss. Custom surgical guide demonstrated better outcomes comparing to navigation surgery in term of achieving same accuracy but less resection time. According to bone tumors can be found in the unusual locations which there is no off the shelf prosthesis, patient-matched prosthesis has gained popularity and played a major role in this area.

Conclusion & Significance: Applying fabrication of 3D printing technology, via custom surgical guide and patient-match prosthesis in bone tumors surgery, has proved the advantages in limb sparing surgery.

Figure 1: Demonstrating the patient-matched prostheses of 5th proximal phalange. We have developed 2 designs which are no constrained and total constrained PIP joint.

Recent Publications

1. Punyaratabandhu T, Liacouras P C and Pairojboriboon S (2018) Using 3D models in orthopedic oncology: presenting personalized advantages in surgical planning and intraoperative outcomes. 3D Printing in Medicine 4(1):12.
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Biography

Sutipat Pairojboriboon is an Orthopaedic Surgeon, specialized in bone and soft tissue tumours. His research interest is the 3D printing technology, focusing on the printed models as an assisted tool for surgery and patient-matched prosthesis. He has experience in working with engineers who focus on the 3D printing technology from the Chulalongkorn University, Bangkok, Thailand, 3DMAC in Walter Reed Military Medical Center, USA and materialize medical company for three years. He has designed a lot of custom surgical guides and patient-matched prostheses in order to perform limb sparing surgery. By using the 3D printing technology, he has proved that his works will help many sarcoma patients from amputation.

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