

# Master track Medical Imaging and Intervention

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## Automatic Camera Movement with Color Tracking in Laparoscopic Surgery

*Group1 : I. Broeders; Kayleigh Dukker, Liza Hashemi, Klaske Siegersma*

### **Abstract**

Since the introduction of laparoscopic surgery in the medical world, surgeons experience problems with the image of the camera. The assistance holds the camera, has a different perspective on the operation field as the surgeon, and experiences discomfort in certain positions, resulting in tremor and sudden movements. Different methods for an automatic camera have been designed and implemented, yet until this day none of them have been of breakthrough in the OR.

Yet, solutions have been designed; A new automatic camera system is designed. This camera works with color tracking on the laparoscopic instruments and automatic guidance of the camera towards the position of the instruments. It must give the solution to all the discommodities that surgeons have experienced with previous automatic cameras.

# Treatment options for a young woman with a large osteochondral defect in the knee secondary to osteonecrosis.

*Group 1: D. Saris; Daan Spoor, Carlijn Tenbergen, Feiko Tiessens, Lydia den Otter*

## **Abstract**

Osteochondral defects of the knee can strongly influence daily activities. The combination of both bone and cartilage damage asks for specific therapy. In this paper a 23 year old woman is presented with a suspected osteochondral lesion and osteonecrosis in her right knee. Several treatment options are described and judged on several requirements. Tissue engineering is the most promising direction to find a long term solution that will regenerate the osteochondral defect. Therefore a combination of scaffold, cells and growth factors are needed. For this patient a good option would be an aragonite scaffold with three layers: for bone, tidemark and cartilage. Additional cells for stimulating regeneration and growth factors to promote revascularization can be added to improve the result.

# A surgical feedback system For thoracic endovascular aortic repair

Group 1; B. Geelkerken; Kim van Noort, Judith Olde Heuvel, Simon Overeem, Kilian Kappert

## Abstract

**Introduction:** Thoracic endovascular stent placement for aneurysmata (TEVAR) is nowadays a commonly used technique. However, overstenting of the aortic arch branches is a serious complication if the aneurysm is placed in the arch. Therefore aneurysmata in the arch are not regularly treated endovascular. In this paper a new method for TEVAR is introduced to avoid overstenting of the aortic arch branches.

**Method:** To prevent overstenting a navigation system is made. This system combines an Electromagnetic Tracking System (MTS) with a previously made 3D CT of the aortic arch of the patient. An ultrasound updates the diameter of aorta in the 3D CT for a real time measurement. The stent is tracked within the patient and the 3D CT is updated with the information of the position and orientation of the stent. The correct place for deployment of the stent is visualized with a green, orange and red light.

**Result:** An user friendly interface for navigational stent placement is obtained. The deployment error of the stent is  $2,43 \pm 0,69$  mm and the diameters of the branched for the brachiocephalic trunk, left common carotid artery and left subclavian artery are respectively  $12.94 \pm 2.04$  mm,  $7.70 \pm 1.21$  mm and  $9.93 \pm 1.47$  mm. The costs of the procedure seem to be less, but a valid statement cannot be made.

**Conclusion:** Navigational placement of aortic stent seems to be a more accurate procedure for TEVAR, however more research must be done to validate this statement.

# Automated control of visualization by a robotic endoscope during laparoscopy through electromagnetic tracking: a new concept

*Groep2: I. Broeders; Astrid Hoving, Marloes Jansen, Tom Jansen, Eline Huizing*

## **Abstract**

In recent years laparoscopic surgery has been gaining ground, leading to new challenges to be addressed. One of those challenges is to address problems arising from an assistant holding the endoscope during surgery, such as the ergonomically uncomfortable positions and the close cooperation needed between assistant and surgeon. The proposed solution is replacing the assistant with a robotic arm guided by a wireless electromagnetic tracking system on the camera- and tooltips. The laparoscopic tools are kept in focus by automatically moving the robot-arm to the desired position, using coordinates from the tips. This solution allows the OR-team to focus on the patient, instead of the camera position.

# A Novel Method For Treating Osteochondritis Dissecans In Adolescents

*Groep 2;D. Saris; Else van der Velden, Levinia van der Velden, Roel Verhoeven, Ruben van Veen*

## **Abstract**

This is a case report on a 23 year old female with a history of successfully treated Non-Hodgkin lymphoma who presented herself with Osteochondritis Dissecans (OCD) at the posterior side of the lateral condyle of the right knee. By using MR imaging for diagnosis and for pre-determining lesions dimensions, a novel fitting method was implemented to fit a three-layered scaffold. The cartilage layer herein is a chitosan – silk matrix mimicking chondral properties, the second layer is a poly-(d,l-lactic-glycolic) acid that will serve as bone growth barrier and the bone layer is a hydroxyapatite – chitosan bone scaffold. The goal of this designed scaffold and implementation method was not only a full recovery of this specific patient on long term, but also meant as a future solution for other cases of OCD.

# One-size-fits-all' stent with Side Branches for TEVAR Treatment of Thoracic Aortic Aneurysm in Zone 0

*Group 2; B. Geelkerken; Peter Pijker, Simeon Ruiter, Anouk van der Schot, Gijs Luijten*

## **Abstract**

Aneurysm rupture is a life threatening situation, where intervention should be done when the aortic aneurysm reaches a critical size. Thoracic endovascular aortic repair is a relatively new minimal invasive treatment for thoracic aortic aneurysms of the aortic arch with clear short term benefits. If the supra-aortic branches are involved in the aneurysm, expensive, time consuming, patient specific stents are necessary due anatomical variations and inadequate sealing zones. An analysis of the ideal stent was performed and leads to a conceptual design of a 'one size fits all' stent graft to overcome the shortcomings of the current stent graft designs. This design is 3D-printed for imaging purposes.

# Smart Glasses: A Gadget or a Real Addition to Interactively Control the Robotic Camera Holder in Laparoscopic Surgery?

*Group 3; I. Broeders; Irene Jansma, Lidewij Neeter, Eliane Nieuwenhuis*

## **Abstract**

Since the introduction of laparoscopic surgery a camera scope is needed and handled by a cameraman, so the surgeon can perform the surgery with both hands. However the view provided by the control of the cameraman is not satisfying in the surgeons opinion. Therefore the question from clinic was to develop a robotic camera holder controlled by the surgeon himself. Problem analysis showed the importance of the control interface for robotic camera holder and the shortcomings of this in nowadays robotic camera systems. Besides the development of a new robotic camera holder the focus of this report is especially on creating an interactive control interface for the surgeon.

**Keywords:** Laparoscopic surgery, rigid scope, work area, robotic camera holder, interactive control interface, 'Google glass',

# A novel approach in scaffold design for an osteochondral defect caused by avascular necrosis

Group 3; D. Saris; Nathalie Versteeg, Carrie Wismans, Manon Tolhuisen

## Abstract

A novel scaffold as improved treatment for avascular necrosis is designed and presented. An open honeycomb structure with a porosity gradient will provide the mechanical properties. PTMC, a biodegradable polymer is chosen as a material for the scaffold. The scaffold will be filled with a hydrogel that provides a gradient of growth factors for both bone and cartilage and provides a protective environment for cells and molecules. These growth factors stimulate cell ingrowth and tissue formation. The focus lies on the use of a honeycomb structure and growth factors for attracting cells instead of implementing cells in the designed scaffold to produce an universal product.

# Iodinated adhesive to improve visualization during TEVAR.

Group 3 B. Geelkerken; Anke Schoutrop, Femke Schröder, Gerard Snaauw

## Iodinated adhesive to improve visualization during TEVAR.

Halted blood flow during TEVAR stent deployment inhibits contrast enhanced visualization of the aortic arch. In the proposed solution an iodinated adhesive is used to mark the orifices of the aortic arch side branches. A concept device is developed for the application of the adhesive. The device is introduced through the iliac artery and advanced in to the side branches for application. The adhesive is fixated to the arterial wall within seconds using ultra-violet light. The contrast markers are used in combination with cone beam CT to align the fenestrations of the stent with the orifices of the branches during stent deployment. Improved visualization will lead to less complications and a safer and faster procedure.