High Quality Low Cost Tumour Knee Prosthesis

Team OrthoCAD
Mechanical Engineering Department
IIT Bombay, Mumbai
Bone tumor in children: cancer can be treated but limb is amputated.

Limb saving surgery: Resect tumour bone, reconstruct gap using prosthesis (imported).

OrthoCAD Project [Funded by the Office of the Principal Scientific Advisor to the Govt. of India]

Modular rotating hinge knee prosthesis

- Ti-6Al-4V Stem
- HA Collar
- Co-Cr-Mo Condyle
- UHMWPE Tibial Poly

Frugal Manufacturing

- RP ➤ wax pattern
- ➤ investment casting

Symphony

Implant Safety and Accuracy

- Walking Simulator

Novel Surgical Instruments

- CAD model
- RP model
- Final Prosthesis
- Surgery plan

OrthoSYS: 3D surgery planning software
How It Started

Feb 2004, Tata Memorial Hospital

First GMRS TKP implantation in India by Dr. Manish Agarwal
Indigenous Knee Prosthesis: Implantation
Orthopaedic and other Reconstruction Projects

Maxillofacial Reconstruction by Distraction Osteogenesis

Auricular Reconstruction

Pelvic Joint Reconstruction
Tumour Knee Prosthesis – High Quality – by Design and Testing

Anatomy

Functionality

Structural Safety

Service Life
# Tumour Knee Prosthesis – Low Cost – by Frugal Manufacturing

## Material Characteristics

<table>
<thead>
<tr>
<th>Material</th>
<th>Characteristics</th>
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<tbody>
<tr>
<td>Co-Cr</td>
<td>High wear resistance</td>
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<tr>
<td>Ti-Al-V</td>
<td>Strength/weight ratio</td>
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<tr>
<td>UHMWPE</td>
<td>Low friction and wear</td>
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## Certified Biomaterials

- Metal Casting
- Hot Die Forming
- Finish Machining
Femoral Measurement and Cutting Jig
Error-prone protocol replaced with guided device

Tibial Cutting Jig ensures cutting plane is perpendicular to bone canal
Prosthesis Implantation – Less Surgery Time – by Preop Planning

CT Images → 3D Model → Landmarks → Deformities → Bone Stock

Selection → Alignment
Project Lead Time Compression – by CAx Integration
Knowledge Dissemination – Clinicians, Teachers, Students
IIT research holds out hope for kids with bone cancer

Mihika Basu

Solutions leading to affordable and long-lasting artificial joints, including accurate reconstructive surgeries for children with bone cancer, are being developed at IIT-B.

The project comprises of engineers, scientists and surgeons from IIT-B, Tata Memorial Hospital and Non Ferrous Materials Technology Development Centre (NFTDC, Hyderabad). It is sponsored by the office of principal scientific advisor to the government of India. The group is gearing up for medical trials by 2009 end.

“Bone cancer primarily happens in children and usually affects the femur (thigh bone). Most of the tumours are observed just above the knee joint,” said B Ravi, professor of mechanical engineering at IIT-B, who is heading the research group. “Now, amputations are not necessary as it is possible to cut out the tumour bone and replace it with mega implant. Imported implants are costly, while the local ones a high failure rate,” he said.

Called the ‘orthoCAD network research facility’, the group is developing orthopaedic implants and surgery planning software for tumour knee reconstruction.

“The artificial joints are designed to give more freedom in movement and last longer. Innovations in manufacturing...
Further Directions – Clinical Trials and OrthoCAD Phase II
New Collaborations – Medical Institutes and Hospitals

Network Enabled Medical Diagnosis & Education in Skeletal Imaging using X-Rays

Indigenous Arthritic Knee Anatomy and Implant
New Collaborations – Orthopedics Manufacturers

Sushrut Surgicals

Indigenous Shoulder and Elbow Prosthesis

Safety Evaluation of Bone Plates
OrthoCAD Lab – Refurbishment (March-July 2009)
OrthoCAD Team – IIT B, NFTDC Hyderabad, Dr. Manish Agarwal

Thank you!

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Challenge – Growing Children – Minimal / Non-Invasive Solution