The Strathclyde Prosthetic Foot
A High Performance Prosthetic Foot for Low Income Countries
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Clinical Need
In the developing world there are ~1-2 amputees per 10000 people1. An amputation can cause significant financial strains2,3,4,5 and social exclusion6,7. The anatomical foot provides shock absorption and energy return8; this needs to be recreated in the prosthetic foot.

The Strathclyde Foot is a dynamic, inexpensive foot for the developing world with a durable, cosmetic rubber casing.

Objectives
The main objectives were:

- To mechanically test the energy return, shock absorption and stiffness of the rubber-cased feet in comparison to the Core and VariFlex foot
- To mechanically test one rubber-cased foot against two feet that are currently available in low income countries
- To analyse gait of two rubber-cased feet in comparison to the VariFlex and Trés feet

Results

<table>
<thead>
<tr>
<th>Method</th>
<th>Description</th>
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</thead>
<tbody>
<tr>
<td>Modify Mould</td>
<td>The core of the Strathclyde foot was encased in rubbers with varying shore densities (10A-40A)</td>
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<tr>
<td>Modify Cores</td>
<td>These feet were compared using static proof testing with an Instron E1000</td>
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<td>Encase Cores in Rubber</td>
<td>The 40A foot was compared to other prosthetic feet used in low income countries. The VariFlex was used as the baseline during all static proof tests</td>
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<td>Static Proof Testing</td>
<td>Gait analysis was carried out on the 10A and 40A feet in comparison to the Trés and VariFlex feet comparing Ground Reaction Forces (GRF) and angles</td>
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<td>Market Comparison</td>
<td>Static proof loading patterns</td>
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<td>Gait Analysis</td>
<td>Gait Analysis using CAREN system</td>
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Discussion and Conclusion

Overview
- Foot complies with ISO BS EN 10328:2006 standards
- Costs under 10 US dollars
- Open source business model
- Has the potential to create employment in low income countries

Rubber Comparisons
- The displacement, energy return and stiffness of the Core were improved by the casings; but not to the level of the VariFlex. This came at the cost of worsening the energy absorption
- No one rubber improved all the properties

Market Comparisons
- Heel of the 40A behaved similarly to VariFlex; showing potential to be high performing
- Creep observed at the forefoot of 40A
- The Niagara was excessively stiff and the ICRC deformed too much; showing they were not high performing

Gait Analysis
- The GRF in the vertical and horizontal plane for the 10A and 40A were statistically similar to the Trés carbon fibre foot
- The GRF in the transverse plane for the Strathclyde Feet and Trés foot were statistically different

Future
- Test between Cores
- Standardise the position of the Core within the casing
- Test other casings
- Test using attachment that will be used with the foot
- Further clinical trials
- Cyclic and static proof testing

References