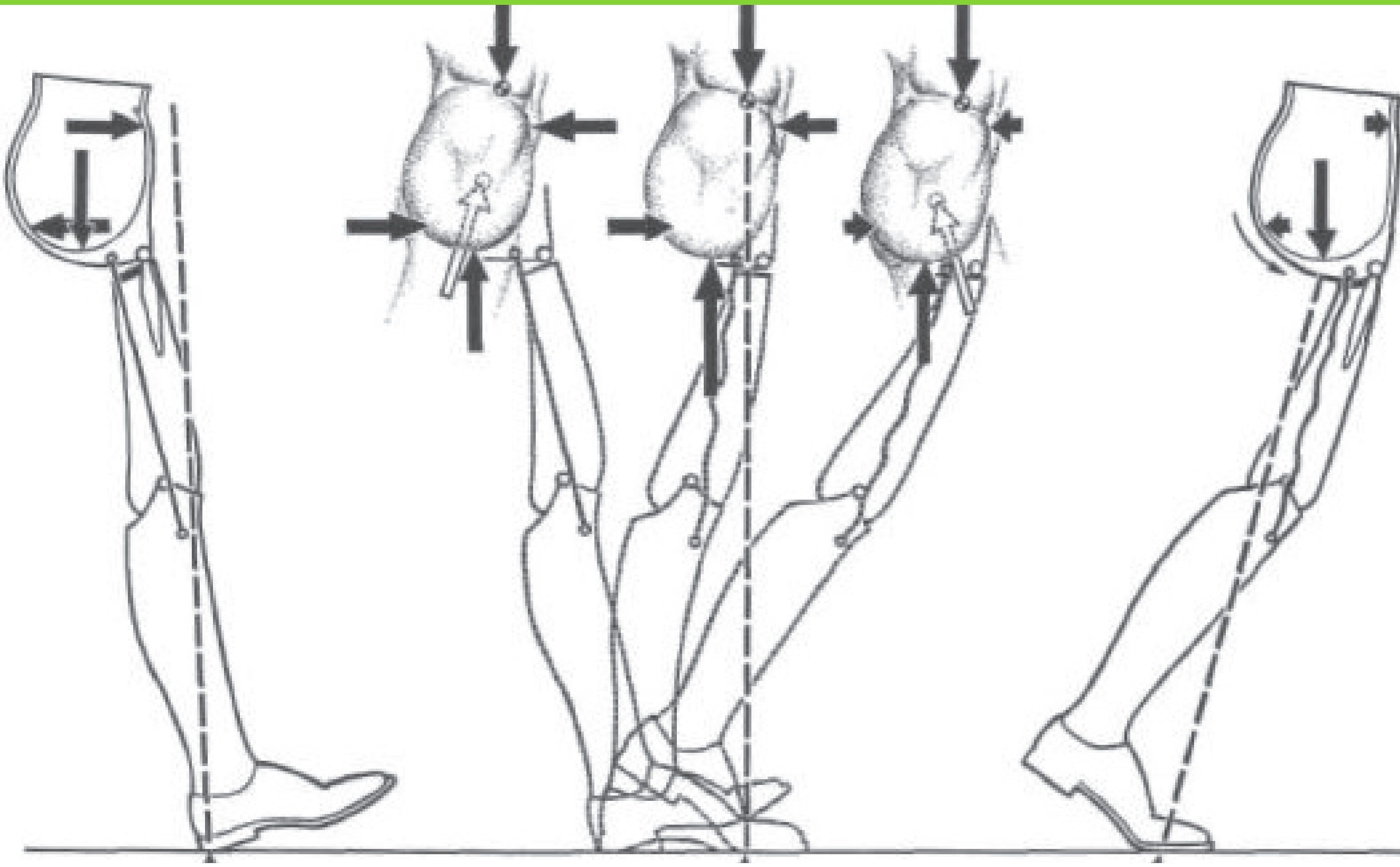
Componentry - Hips



Prosthetic management of the Hip, trans-Pelvic and Lumbar regions is a rare opportunity for the treating Prosthetist, and a significant challenge for the amputee. The physical loss, often complex co-morbidities, and the amount of energy required to walk with these prostheses (Approx. 200% more than normal walking) can often mean prosthetic management is overlooked.

The Amputation levels that would require the use of a prosthetic hip joint are any level where the femur has been removed or is too short to provide functional movement and control over prosthesis; these include;

- Very short Trans-femoral amputation
- Hip disarticulation
- Trans-pelvic
- Hemi-pelvectomy or hind Quarter
- Hemi-corporectomy
- Trans-lumbar

The most common causes for this level of amputation is the management of aggressive bone and soft tissue tumors. Traumatic loss at this level is not unheard of but quite rare due to factors such as blood loss and the multiple traumas associated with high impact injuries.

What functions does a Hip need?

The Prosthetic hip needs to transfer the weight of the body safely from the socket to the ground via the knee, ankle and foot. Just as importantly the Hip must allow at least 90 degrees hip flexion for sitting whilst not overly affecting the height or level of the pelvis.

To achieve this most modern Hip joints have an L-Shaped anchor plate that is attached to the front socket. This design wnables hip flexion without greatly impeding sitting balance. (Fig.1)
When compared to the

functional variability of the prosthetic knee joints (described in issue 7) the currently available hip joints are much simpler by design. The differences in available Hip joints across prosthetic suppliers are essentially quite small. Most hips have an extension assist of some design, be it an externally placed elastic band or an internal spring mechanism as illustrated in figures 1&2. Additionally to this some hips have a simple locking mechanism that prevents any movement whilst standing and walking. (Fig.2)

Carbon Composite strut systems have also been added to offer dynamic motion and some shock absorption during stance. These systems have also been reported to increase the speed with which the knee flexes for swing phase. (Fig 3)

The design of the socket, foot and knee used by the Prosthetist will have as great or greater affect over ultimate function than the hip joint design alone. In the 1950's Radcliffe's biomechanical analysis of the forces necessary for ambulation led to the development of the "Canadian" design (now the most commonly used), which demonstrated that locked joints were unnecessary in hip disarticulation/transpelvic prostheses, (Van der Waarde & Michael, Atlas of Limb Prosthetics Chapter 21B, 1992).

Once the Socket and hip design has been selected by the Prosthetist, the selection of the knee and ankle components are similar to that of above knee amputees (transfemoral). However, toe clearance when walking is more difficult to achieve due to the passive nature of the Prosthesis. This means that generally the Hip or Trans-pelvic prostheses are deliberately shorter than the sound side.

The Success of this often cumbersome prosthetic management will rely on the comfort of the prosthetic socket, the alignment of the carefully selected (patient specific) prosthetic components and most of all the balance and motivation of the amputee.

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FIG 1 Prosthetic hip with internal spring extension assist

FIG 2 Prosthetic hip with lock

FIG 3 Prosthetic Hip with carbon composite strut

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