Endolite Stance Flex Stabilised Knee Unit.
Betchworth, England.
Australian Agent: Orthopaedic Techniques;
Seven St.
Richmond, Vic.

The intention of the assignment is to briefly assess the Endolite Stance Flex Stabilised prosthesis knee unit. Comparing the manufacturers statements with an assessment of an amputee using this prothetic knee.

The key features of the unit is the pivot plate and compression element proximal to the knee axis. This allows the socket to 'give' in stance but maintain its extension stability. It allows the prosthesis to simulate knee flexion during stance. Other features include carbon fibre composite shank and aluminium alloy knee unit parts. This makes the prosthesis relatively lightweight.

In normal gait for a non amputee, the knee angles are as shown by the graph.

![Graph showing knee angles during gait.]

The knee angle in stance increases flexion to approximately 20° at flat foot. This corresponds with weight transfer in double support phase. The main reason for the controlled flexion in stance is the muscle groups in the lower limb compensate the ground reaction forces about the knee with its respective ligaments.
The different muscle groups maintain stability throughout stance by offering the ground reaction forces.

The knee flexion in stance assists in lowering the centre of gravity slightly at Mid Stance, preventing a vaulting type action. This would occur if the extension angle of the knee, giving a long pendulum action.

For an above knee amputee using a single axis prosthesis Knee unit - Class 2, knee 1,2, or 3 or Class 3, Type 1. The knee equal load stable is placed in extension and is maintained in extension throughout stance until heel rise. This is due to the need to keep the ground reaction force anterior to the knee axis, which locks the knee. At heel rise the ground reaction forces begins to move posteriorly, bending the knee.

One of the effects of having the locked knee in stance is the centre of gravity is held up high. Causing a greater use of energy in the muscles as the compensated leg works above the prosthesis. It would be likened to walking up hill and then rolling off after Midstance. This is one of the reasons why so many prosthetists make the prosthesis slightly shorter.

The Stance Phase Lockable Knee unit maintains this anterior ground reaction force to the knee axis, which maintains stability. The difference lies in the pivot plate and the compression element. As the prosthesis begins heel strike, the compression element begins to load, deflecting the pivot pad thereby giving the flexion characteristics.

The unit gives good shock absorption from impact loads at heel contact. When used with the Endurable Multiflex Ankle unit this shock absorption is further assisted.

Blatchford also maintain amputees feel more comfortable with this unit; it assists greatly in downhill walking; gives a smoother gait; energy expenditure is less due to the lowered centre of gravity; no vaulting action occurs. Energy stored in the compression element during stance is released in early swing phase.
The unit has been designed to work with pneumatic or hydraulic moving plate
socket units or with an external self-spring.- Extension resist.
The compression elements can be changed (with great difficulty). There are
three types of varying diameters. The standard unit will give approximately
10° of flexion in stance.

Observations and Comments:

The amputee observed was an active established 7½ length L/H amputee. We
marked a vertical line running through the socket, hinge axis, shackle after
after dynamic alignment was fine tuned. This line acted as our reference
line.
A video recording was made at the amputee's comfortable cadence. The
shutter speed was 6000 sec. 25 frames/sec.
1 dose 2 strides from heel contact to at least mid stance or heel strike. Some
strides did not film well for this.
I measured the angles of the frames. The general observations found was
angle of the socket away from the marked vertical line maintained an
extension angle throughout. At a point approaching flat foot a 2° maximum
flexion angle was noted in one stride.
I realise the data from these observations needs statistical analysis and does
suggest further study into this unit.

Possible reasons for these observations:

The compression element is too hard for the amputee.
The effect of socket alignment? The knee unit has a pneumatic serving phase
control unit which allows the socket to be placed on 'iwasher' - the TKA line.
This means the weight line - therefore the ground reaction force is held anterior
to the hinge centre or on it in this case in stance possibly preventing the flexion.
Maybe the compression element needs to be placed over the hinge axis?

The amputee did comment favorably to the feeler of smoother gait action
than his other prosthesis without this unit.

Overall an interesting observation with a need to look at this unit in more
detail. I tend to doubt some of the 'rule of thumb' information about this unit.
I see a greater need to quantify scientifically more and more of our amputee.
3.4.4 ILLUSTRATION

KNEE FLEXION RUBBER

WEBBING STRAP

KNEE CENTRE

FLEXION STOP FACE (115° MAX)

SPRING STACK ADJUSTER WHEEL & LOCKING SCREW

PSPC EXTENSION STOP ADJUSTER

C ALIGNMENT

6 mm

FRONT PIVOT PIN AND LOCKING SCREWS

BEARING ARM ADJUSTER SCREW & LOCKING SCREW

EXTENSION STOP ADJUSTER SCREW

PATELLA & RETURN SPRING

FRONT EXTENSION STOP & P.U. BUFFER PAD

ENDOLITE STANCEFLEX STABILISED KNEE
SECTION 5. APPENDICES

5.1 STANDARD ALIGNMENT AND MINIMUM BUILD LENGTH

5.1.1 STATIC BENCH ALIGNMENT

KNEE CENTRE
KNEE CENTRE MAY BE SET BACK 0-5mm ON FREE KNEE'S FOR EXTRA STABILITY. ESK NORMALLY SET ON VERTICAL REFERENCE LINE.

VERTICAL REFERENCE LINE

ANKLE CENTRE

POSITION OF MANDREL (FLAT POSTERIOR)

END OF STUMP
69mm ESK 58mm EUK (NO SPACERS)

350 MIN

0-15mm
KNEE CENTRE FORWARD SET (ON LOCKED KNEE) TO IMPROVE COSMETIC EFFECT ON LIMB WHERE EXCESSIVE FLEXION OF SOCKET IS REQUIRED

ALL LIMBS

SACL ONLY WITH EXCESSIVE FLEXION