

Hilightening of navigation of the pelvic tilt through a "in vitro" study

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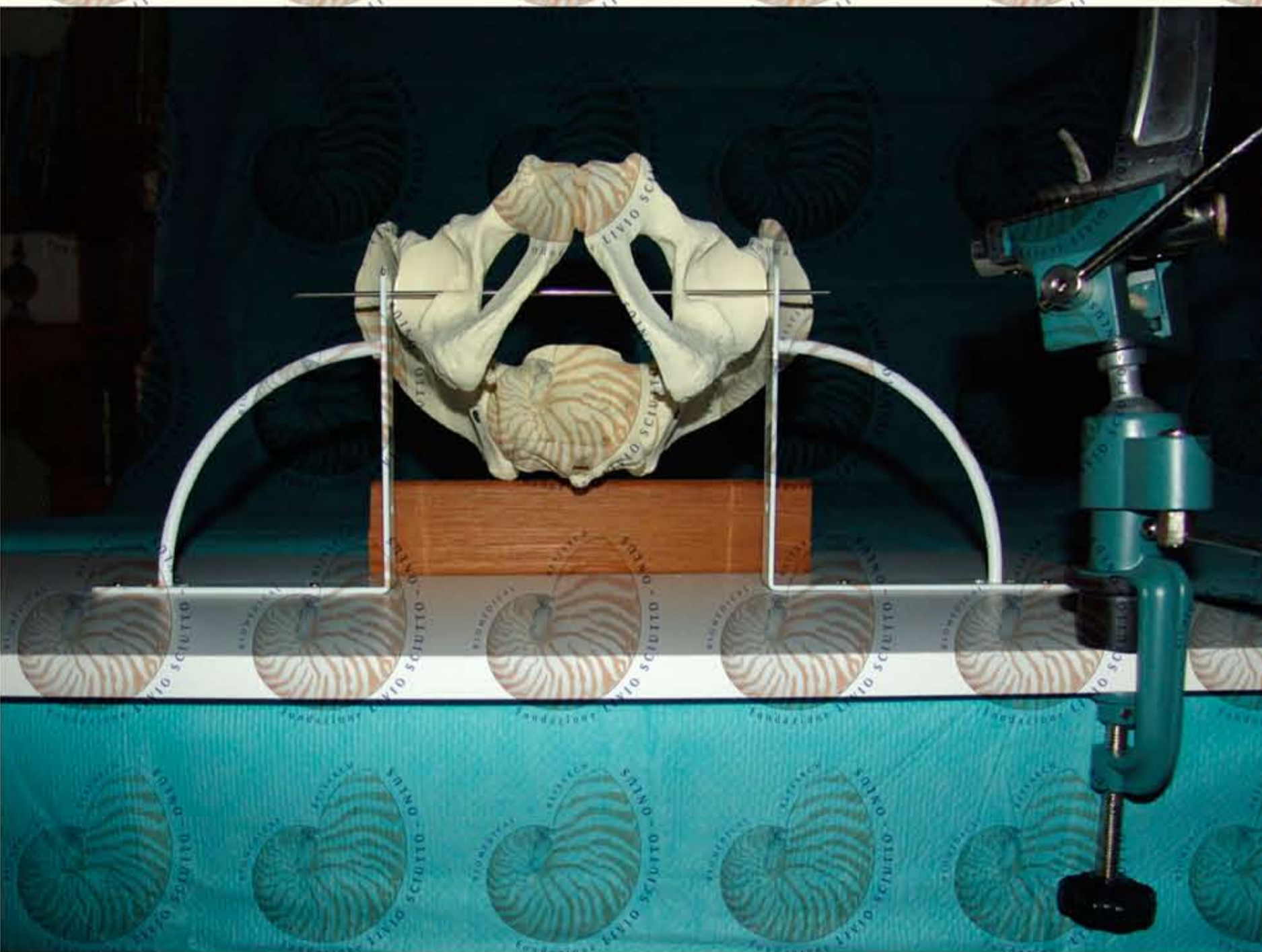


Introduction:

Introduction: Navigation of the hip presents some important aims which come into effect in clinical practice as improved control of leg length discrepancy and articular stability after Arthroplasty. Navigation is a methodical process that lends a helping hand in the attainment of these aims, particularly in relation to the minimally invasive techniques where poor visualization of bony landmarks can effect the correct positioning of the prosthetic components. Since our first experience that started in June 2000 with the navigation system 'Navitrack' (CT based) we have been able, in some cases to observe, some important differences in respect to the inclination degree and anteversion planning.

For example, a limited case was followed and explored with average simulation. Clinical experience suggests a position in which attribute navigator 62,9° of inclination and 47,1° in anteversion, on average this information was signed 58,3° inclination and 36,4° anteversion to under estimate the functioning position of the subject that in a horizontal position, presented a marked tilt of the pelvic bone verified by follow up lateral X-ray in a standing position.

Correcting the tilt, that assigns the navigator to a system of co-ordination that reflects the live functional result and not simply the anatomic plain that passes the pubic bone and the iliac spines. We were able to verify, to our surprise, that the marked degrees based on surgical experience, were read as 44° inclination and 29° of anteversion. Therefore, the aim of the study was to demonstrate and rationalize the influence of the pelvic tilt in the position of acetabular components.



Methods:

An experimental device was built. This model included a bracket shaped form that rotated the pelvis just around the acetabulum rotating centres, through which a 3.2 mm pin was inserted. In this way it was possible to mimic the tilt functionality as in vivo. Above all precisely measuring the entity. Exclusively the results of the anteversion, the impactor tracker (gun) were fixed onto the set up with an inclination of 46°, where as the anteversion was assigned, for every cycle of measurement, respectively at 5°, 10°, 15° and 20°.

For anteversion data the positioning of the pelvis was assigned to a zero tilt therefore, this varied step by step at 5° starting from -25° to +25° exploring the pelvic retroversion with the tilt ahead and every cycle of measurement calculated the variation of the anteversion itself.

Result:

Repeated measuring was carried out to find out the minimal accidental variations that could happen by means of registration. From the average data it was possible to extract and graph the correlation between the tilt and the anteversion, that synthetically expressed and demonstrated a variation of 50° in a explored tilt variation of 37° in respect to 10° anteversion "base-line" (that is considering a natural position tilt), and a minimum of 32° for the 20° "base-line". The average discrepancy of the anteversion was considered for every 5° of tilt and was 4° in the case of front rotation (positive tilt) and 4,7° for the inverted pelvis (negative tilt).

Discussion:

This simple study allowed us to enrich the navigation of the correcting parameter which is very important for the positioning of the acetabulum components. This explains the meaning of a "nominal" anteversion (that is referred to an anatomic plain that corresponds to a 0° tilt), for example at 13° in a subject in which the pelvic bone tilt is at 15° it would take on a functional position to the same value of about 25°. This invites us to comprehend better the meaning of anatomic orientation and reduce the discrepancy with live studies about functional anteversion. With the radiographic anteversion, the supine patient is justified to discordance between the navigated anteversion and "surgery" in the lateral position. Taking away the problem to calculate the tilt live subject.

Nominal	25°	20°	15°	10°	5°	0°	5°	10°	15°	20°	25°	
Anteversion	5	-16	-12	-8	-4	1	5	9	10	13	17	20
Anteversion	10	-8	-6	-4	1	3	10	15	19	23	26	29
Anteversion	15	-3	-1	5	7	11	15	18	22	25	28	32
Anteversion	20	2	5	8	13	17	20	22	25	28	31	34

less/nominal	more/nominal	anteversion range
-21	15	36
-18	19	37
-18	17	35
-18	14	32

