Outlet Anterior Posterior Diameter: Can new values for dynamic coccygeal extension increase outlet APDs and physician-maternal confidence in vaginal route deliveries?

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Opinion Paper

Introduction:

A review of the literature revealed an array of data questioning the sensitivity and clinical usefulness of pelvimetry in predicting route of delivery, except in obvious cases of breach, shoulder or other emergent dystocias. While both pelvic and fetal imaging has improved with ultra sound, computed tomography (CT) and magnetic resonance imaging (MRI), surgical route deliveries remain at an all time high(1).

This paper discusses a dynamic assessment for measuring outlet anterior posterior diameter (APD) based on normal natal physiologic extension of the coccygeal segments. The method assumes that normal cephalic vaginal deliveries depend upon a greater degree of coccygeal extension, during crowning, than previously reported, possibly as much as 30 to 60 degrees. Historically, route of delivery has been influenced by pelvimetry that based its outlet APD assessments on static prenatal or early stage labor pubococcygeal dimensions that do not accurately reflect maternal potential for dynamic coccygeal extension proposed to be necessary for pelvic floor distension and successful cephalic parturition. With as much as a 1-3 centimeter difference in outlet APD herein thought to separate a static coccyx from one capable of dynamic extendability, this paper presents a rationale for increasing confidence in otherwise uncomplicated cephalic presentations as well as in trial of vaginal birth after Cesarean section (VBAC).

History:

Delivery by cesarean section is reported to have been 4.5% in 1965 and 5.5% in 1970. The Centers for Disease Control reported that birth by Cesarean section had increased to 31.8% in 2007(1). There is widespread concern about this trend, particularly in the United States(2).

Review of literature:

No studies could be found that attributed the increase in surgical deliveries directly to coccygeal dysfunction. Most pelvimetric analyses we found were static in their methodology(3-6). Several were found that took pelvic floor dynamics into consideration. The first documented dynamic pelvic floor excursion of 17-degrees with MRI in non-pregnant, asymptomatic men and women(7). Pelvic floor excursion occurred between maximum contraction of pelvic floor musculature and straining-evacuation. Of the 112 patients measured, all but one demonstrated dynamic pelvic floor descent. This greater than expected normal coccygeal motion is further seen in a coccygodynia study(8) that found static anterior angulation ranged from 52.3 degrees in the asymptomatic control group to 72.2 degrees in the idiopathic coccygodynia group. A significant 92.3 % improved with conservative treatment. More research is needed to help determine the range of coccygeal motion and pelvic excursion occurring naturally at crowning during normal successful cephalic parturition.

Others looked at the biomechanics in a three-dimensional computational model that simulated the movements of the fetus during vaginal delivery(9,10). They defined the influence pelvic muscle activation and cephalic orientation had on the pelvic floor during vaginal delivery without mention of coccygeal function. More research is needed to compare pelvic floor muscle function in women with sacrococcygeal hypomobility and coccydynia to those with coccyges that are resilient to extension.

Another study looking at racial differences in pelvic anatomy utilized dynamic MRI in assessment of Caucasian and African American women(11). They found that obstetrical tears were more frequently sustained by women who had less pelvic floor mobility. This group experienced more tears even through they genetically had the widest obstetrical conjugates and outlets. The only statistically significant difference, that could possibly explain the tears, was .6 centimeter decrease in mean APD and less pelvic floor mobility. These findings support our rationale that a hypomobile coccyx is a primary cause of decreased functional APD and impaired pelvic floor mobility. More research needs to compare the occurrence of obstetrical tears in women with and without impaired coccygeal extendibility.

Illustrations of typical coccygeal alignment affecting outlet anterior posterior diameter (APD)

Figures a: Illustrates axial view of the coccyx while in normal, anterior and extended positions
Figures b: Sagittal view of pelvis with left ilium removed

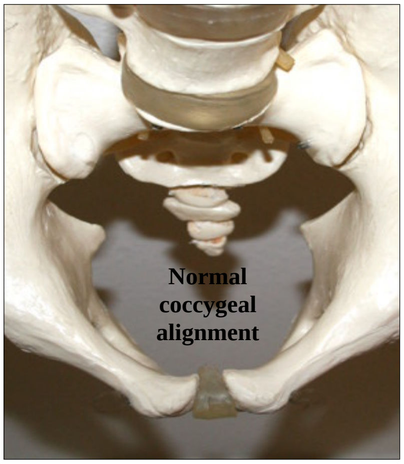

Fig. 1a. Fig. 1b.

APD appears marginal with static pelvimetry. Obstetrical examination utilizing firm traction can quickly determine if coccygeal extension is impaired or not. Abdominal delivery may be planned with certainty if coccyx rehabilitation fails to achieve sufficient coccygeal mobility in extension.

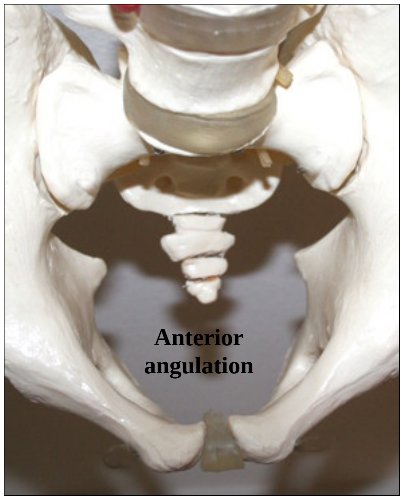

Fig. 2a. Fig. 2b.

Outlet easily reduced to 9–centimeters or less, depending upon length of the coccyx and degree of anterior displacement.

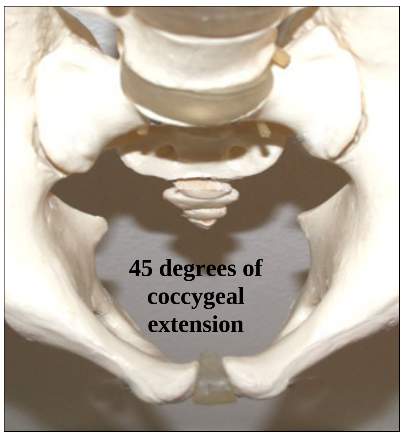

Fig. 3a. Fig. 3b.

Coccygeal extension of 45-degrees greatly increases APD. This degree of motion is easily achieved, according to Kemper and Wooley, in healthy patients with a little provocation.

While several studies have questioned the accuracy of radiographic pelvimetry, the lack of confidence in APD assessment is not limited to rentgenological studies. The aforementioned study(11) that looked at racial differences in pelvic anatomy found high variability among readers of pelvic MRI measurements. Another study, utilizing CT to assess pelvimetry for the purpose of quantifying intraobserver and interobserver reliability(12) found only 1-2 millimeters of observer variation in all inlet and interspinous measurements. Their outlet variation, however, was nearly .5 cm, so large as to make the measurement of doubtful clinical utility, according to the authors. More research is needed to assess why outlet APD is reportedly the most variable of all pelvimetric dimensions.

Summary of research:

With the exception of outlet APD, pelvimetric analyses enjoy low interobserver variation. Interestingly, no dynamic studies identified pelvic floor or coccygeal excursion beyond 17 degrees (.9 cm)(7) or 1.5 centimeters(11). This range is consistent with studies indicating that recommendations for route of delivery are often determined by as little as 1-centimeter of outlet APD derived from static assessment. In addtion, no studies were found to mention prenatal obstetrical testing of women to help determine an individual’s capacity for coccyx and related pelvic floor excursion. Certainly, imaging of pelvic floor excursion during cephalic crowning in normal vaginal deliveries will be a challenge to obtain due to motion at parturition and for safety reasons. Nonetheless, more research is needed to compare route of delivery in women assumed to have reduced APDs based on static pelvimetry and affected by truly hypomobile coccyges, to those with the same reduced APDs but whom upon the proposed prenatal dynamic assessment of coccygeal extension, demonstrate normal supple 30-60 degree extendability (Figure 3a. and 3b.).

Clinical assessment of dynamic pelvic floor excursion and APD

The authors’ opinions arise from clinical chiropractic / orthopedic experience gained in manual treatment of common, chronic, Pratt fall-related pelvic floor injuries in men and women. Approximately 5,000 examinations and treatments have led us to the opinion that the coccyx, and the immediately coextensive musculoligamentous tissues of the pelvic floor, can lose much of their natural excursion particularly in the presence of serious anterior coccygeal angulation or dislocation. This non-obstetrical opinion is based on immediate improvement in pelvic function following the authors’ firm provocation of coccygeal extension with manual, often analgesia-assisted, traction and mobilization. The procedure described by Kemper and Wooley(13-16), has enjoyed an excellent safety record and favorable outcomes while attempting to achieve full and optimal coccygeal extension in men and women.

A possible explanation for the international lack of reference to dynamic coccygeal extension, beyond 17-degrees or 1.5 centimeters, in pelvimetric analyses could be that many orthopedic authorities remain of the opinion that coccyges are little more than vestigial remnants with little or no natural motion, perhaps up to 30 degrees, that often require surgical removal when symptomatic(17,18). While these authors agree that all joints are prone to loss of motion, articular fibrosis and progressive fusion when traumatically displaced, we have found that coccyges are naturally capable of far more range of motion than previously reported(7).

While coccyges often lose mobility it is the author’s consistent experience over 25-years of daily management of pelvic floor injuries that coccyges are highly responsive to manual medical therapeutics designed to provoke and rehabilitate dynamic coccygeal extension to ranges well beyond values reported in the literature. Figures 1a-b. illustrate a pelvis with marginal outlet APD. Assuming a static or hypomobile coccyx, CPD is a very real concern. Figures 3a-b. illustrate a dramatic increase in APD, enabled by coccygeal extension, where CPD is far more unlikely.

Fig.4. Contact used to extend the coccyx and distend the pelvic floor. About half of the women with coccygeal hypomobility were previously diagnosed with CPP.

Conclusion:

While more research is needed to compare prenatal static APD to APD occurring in successful vaginal deliveries, the authors’ respectfully suggest that normal vaginal delivery depends upon considerable coccygeal extension in order for pelvic floor distension and cephalic presentation to occur. More research is needed to determine if dynamic assessment of outlet APD, in women with otherwise sufficient obstetrical conjugates may improve confidence in vaginal delivery in primiparas and in trials of labor after cesarean. It is beyond the scope of this paper to review procedural guidelines for treatment of the sacrococcygeal (SC) syndrome.

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