Dynamic films. Techniques and results. The different lesions of the coccyx. Pitfalls in interpreting coccyx lesions

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DYNAMIC FILMS. TECHNIQUES AND RESULTS. THE DIFFERENT LESIONS OF THE COCCYX. PITFALLS IN INTERPRETING COCCYX LESIONS

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INTRODUCTION

We first described dynamic X-ray films of the coccyx in 1992 (1). The goal was to obtain an image of the coccyx when it was painful (i.e., in a sitting position) and compare this it with a standard X-ray in a standing position. This technique enabled better understanding of the various pain mechanisms in coccygodynia. In the literature, these are called dynamic films, sit-stand X-rays, stress radiographs, or functional X-rays. In all our studies, we use the term "coccyx flexion" when the tip moves forward and "extension" when it moves backward.

TECHNIQUE

Standard film X-rays should be taken first, always in the standing position and never in lateral decubitus. This is considered the reference position for our measurements, including in control subjects; the weight of the viscera results in a small extension to the coccyx. In lateral decubitus, the coccyx is relieved of this weight and slightly flexes under the effect of the pelvic floor muscles. Its position also varies relative to the degree of hip flexion. Ideally, the image should be focused on the coccyx and inferior sacrum to limit radiation and improve the visibility of the coccyx. A frontal film is useless. The sitting film is taken second. The patient is seated with a straight back and their feet on a foot rest. If pain is not felt in this position, the patient slowly and gradually leans backwards until it is felt. It is essential to allow sufficient time for the pain to occur. Genuine lesions may not be seen if the film is not taken with pain; therefore, it is important to ask the patient to tilt their pelvis forward and backward [Fig 1-2].

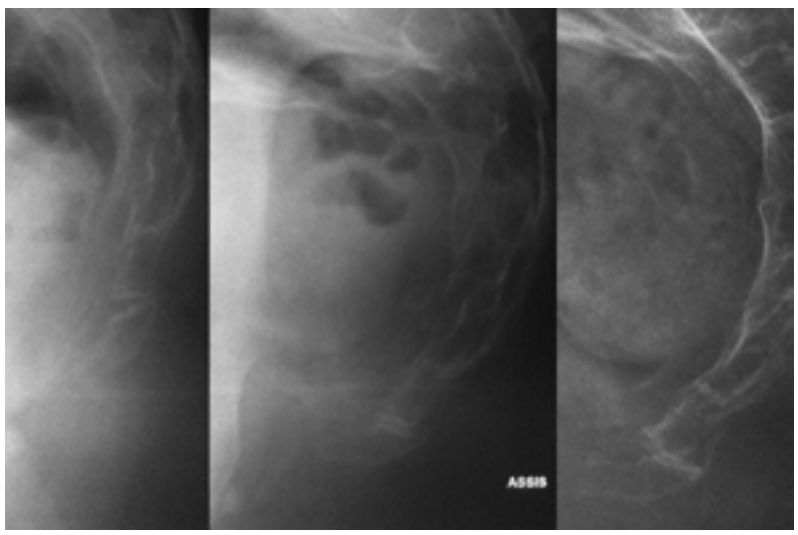

Figure 1. Left: Standing film. Center: Sitting with no pain; the pelvis is not sufficiently tilted. Right: Sitting with pain. Dislocation.

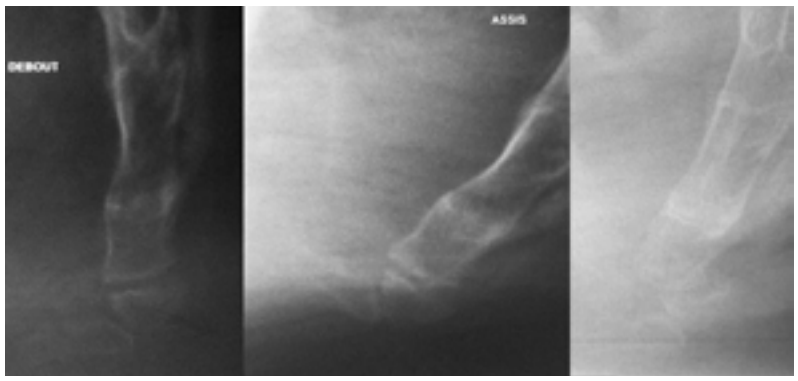

Figure 2. Left: Standing film. Center: Sitting with no pain; the pelvis is too much tilted, preventing the dislocation from occurring. Right: Sitting with pain. Dislocation.

READING DYNAMIC FILMS

The quality of standard film is generally better than that of sitting film. Various lesions can be diagnosed including spicules, retroversion, intervertebral disc calcifications, and fractures. These are described in detail below.

To assess coccyx mobility, both films (not printed on photographic paper) need to be superimposed by lining up the two sacrums [Fig 3]. The mobility of the coccyx appears and can be measured as an angle whose apex is the centre of the first mobile disc. The intra- and inter-observer reproducibility is satisfactory (2). Two other angles can be calculated that provide better understanding of coccyx biomechanics: the pelvic rotation sagittal and the incidence of the coccyx (3). Sitting film quality is not always perfect. Artefacts are also likely, leading to interpretive errors [Fig 4].

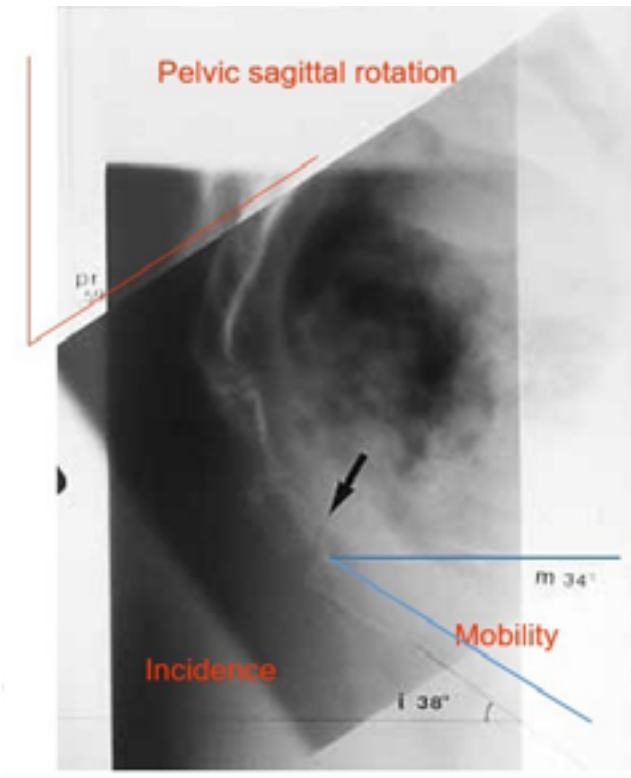

Figure 3. Reading dynamic films. The sitting film is laid over the standing film by lining up the sacrums. The sitting film needs to be tilted at an angle that corresponds to pelvic sagittal rotation when the patient sits from standing. The mobility angle can then be measured (except in the case of a dislocation). The last angle that can be calculated is the coccygeal incidence or angle created by the coccyx with the seat just before being moved by the pressure of the seat.

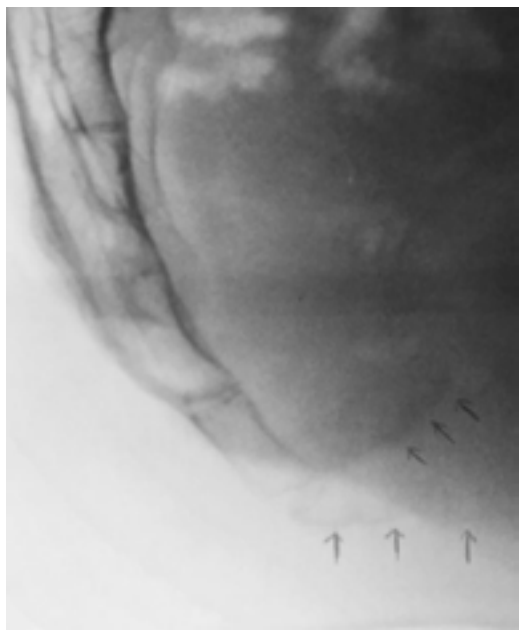

Figure 4. False image (artefact) of the coccyx (upper arrows). The real coccyx is horizontal (lower arrows).

POSTERIOR DISLOCATION OF THE COCCYX

Posterior dislocation (or luxation) is defined by a backward displacement of the coccyx, which may or may not be associated with extension [Fig 3]. This displacement is generally >50%. A displacement <25% may exist in non-symptomatic subjects (2 cases in our control group of 45 subjects (3)). It represents 20% to 35% of coccygodynia cases according to the series.

Dislocation generally occurs on vertical and straight coccyges or without great curvature. The vertebra that luxates often has a cuneiform appearance [Fig 2-5]. The lower side of the disc is very often oriented backward, which facilitates sliding, and the vertebra above the dislocation sometimes presents with a backward counter-curvature, thereby increasing disc obliquity. Together, these three elements contribute to the "luxating" coccyx.

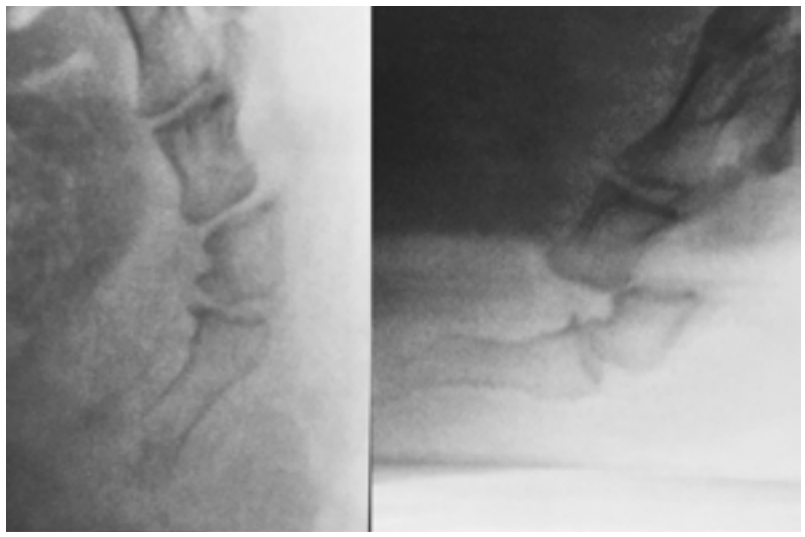

Figure 5. Dislocation of the coccyx in the sitting position. Note the reshaping of the bone at the point of contacts between C1 and C2 and between C2 and C3 due to C3 hypermobility in flexion.

HYPERMOBILITY IN FLEXION

In our 1996 control series, mobility of the normal coccyx was 9.3° ± 5.7° between standing and sitting (2), but this value included cases of extension mobility, which was less than half. In addition, we find today, at least in patients, that vertical coccyges are generally rigid while forward curving coccyges are suppler. The experience showed us that in very supple patients, coccyx mobility could be significant (around 25°) without being painful. Consequently, we now consider that a flexion angle >30° defines hypermobility in flexion. It represents around 20% to 25% cases of coccygodynia [Fig 6-7]. The question of knowing whether hypermobility itself is likely to be the source of pain or whether it is triggering factor for a discal lesion or even the simple outcome of a discal lesion remains open to debate. Two other radiologic signs that could appear in sitting position and make its pathological nature more likely are misalignment of the distal coccygeal segment (discrete anterior subluxation) and bone contact of the two vertebrae [Fig 6-7].

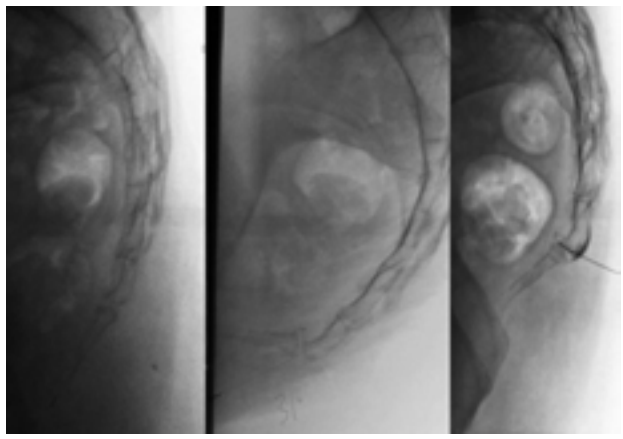

Figure 6. Hypermobility in flexion measured at 31° with discrete anterior subluxation visible on the sitting film (centre) and small anterior osteophytes

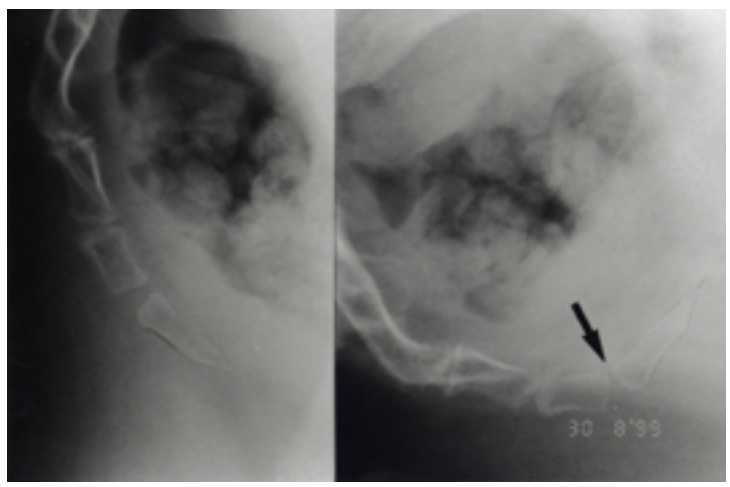

Figure 7. Hypermobility with anterior disc space narrowing and contact with bone surfaces (arrow). Sitting film on right.

ANTERIOR DISLOCATION

Anterior dislocation (or luxation) is a variant of hypermobility in flexion (4). It represents around 5% of cases [Fig 8]. It always concerns the most distal portion of the coccyx.

A very rare variant is the irreducible anterior dislocation, which is caused by violent external trauma and affects the entire coccyx [Fig 9]. The three cases that we have seen to date spontaneously recovered with the coccyx remaining in the wrong place. The first case was observed on the second day following trauma and could not be reduced under general anaesthesia. The other two were observed a little later. Within a few months, a neo-sacrococcygeal joint had formed, making the coccyx painless.

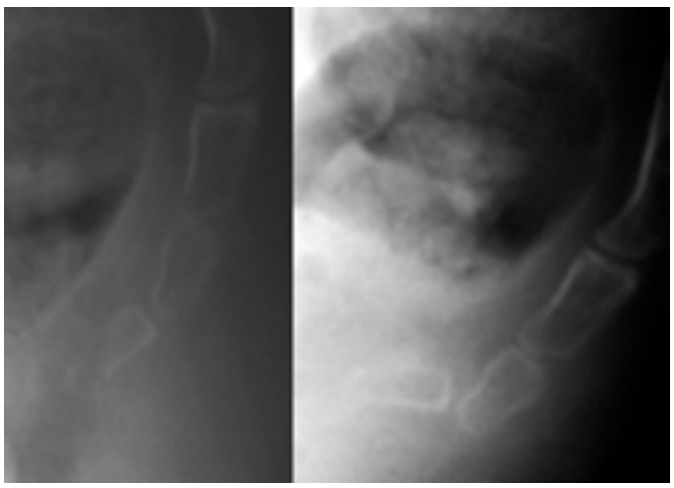

Figure 8. Anterior dislocation

Figure 9. Irreducible anterior dislocation after violent trauma.

HYPERMOBILITY IN EXTENSION

Hypermobility in extension is a rare lesion (1% to 2% of cases). We consider it the equivalent of a posterior dislocation [Fig 10]. While there may not be complete loss of contact between the bone surfaces in this instance, it concerns movement that is not adapted to coccyx function in the sitting position.

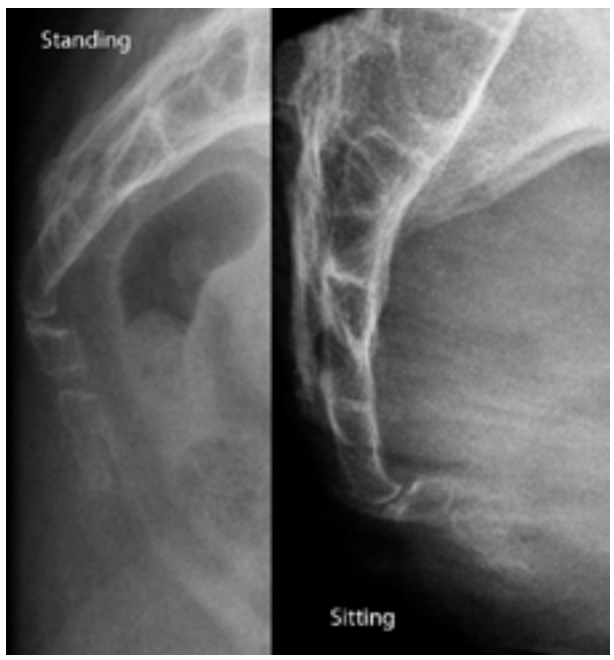

Figure 10. Hypermobility in extension

COCCYX SPICULES

We described spicules of the coccyx in 2000 (4). This morphologic abnormality appears as a small bony excrescence on the dorsal aspect of the tip of the coccyx [Fig 11]. The pain originates from the irritating action of the spicule on neighbouring soft tissues. Bursitis is often associated. A spicule can only become symptomatic if the coccyx is rigid. Otherwise, in the very rare case of a spicule borne by a mobile coccyx, coccyx flexion in the sitting position prevents its invasive action. Figure 12 shows the spicule sinking into the soft tissue in a sitting position. Small spicules are better visualized on computed tomography [Fig 13].

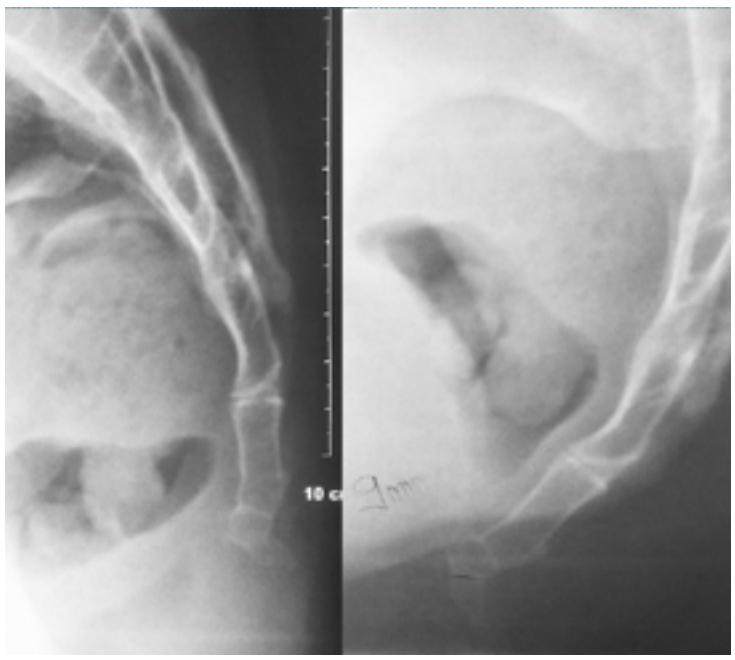

Figure 12. Large spicule. In a sitting position (on right), it sinks into the subcutaneous tissues

Figure 11. Spicule at the tip of the coccyx (standing position).

Figure 13. Short spicule more visible on computed tomography

COCCYX RETROVERSION

This is a fairly rare lesion, very similar to a spicule. Here, the entire lower part of the coccyx is tilted backward, and thus the term retroversion[Fig 14]. These are entirely rigid coccyges, sometimes fully ossified. It is sometimes possible to opacify an apical serous bursa, not described in the anatomy treaties, which is probably the seat of bursitis [Fig 15].

Figure 14. Retroversion of the coccyx. Sitting film on right.

Figure 15. Opacification of an apical serous bursa.

RIGID COCCYGES WITH NO SPICULE

The lack of coccyx mobility in sitting position is often seen in healthy subjects and is not abnormal in itself. However, when seen in the context of coccygodynia, it usually presents as pain at the tip of the coccyx but without a visible spicule [Fig 16] or retroversion. The cause of pain could be either bursitis of the apex or a mechanical bone/subcutaneous tissue conflict. Rigid coccyges without spicules represent around 10% of cases of coccygodynia.

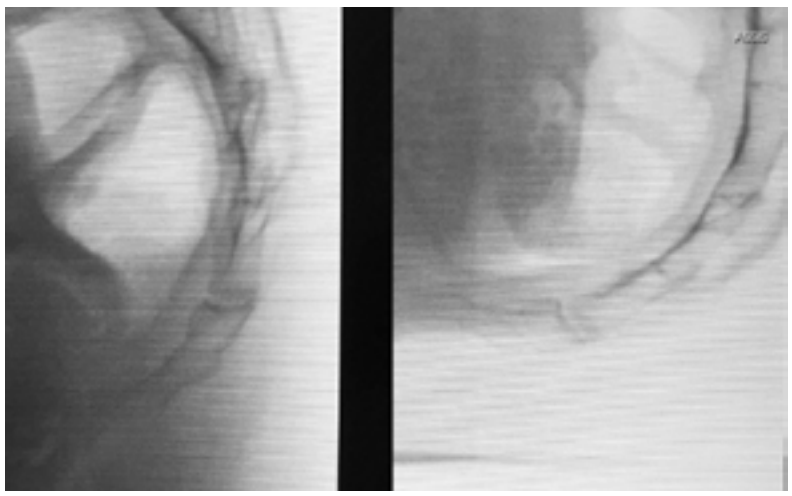

Figure 16. Rigid coccyx, no spicule. Sitting film on right.

OTHER LESIONS VISIBLE ON DYNAMIC FILMS

Fractures, calcifications, and deformations of the coccyx are described in another article.

NORMAL MOBILITY COCCYX

Finally, in more than one third of cases, dynamic X-ray films show normal mobility between 5 and 25°. In some cases, disc narrowing, contact between two adjacent bone surfaces, and the presence of small osteophytes can be observed in the sitting position. In our experience, these elements indicate degenerative disc disease [Fig 17].

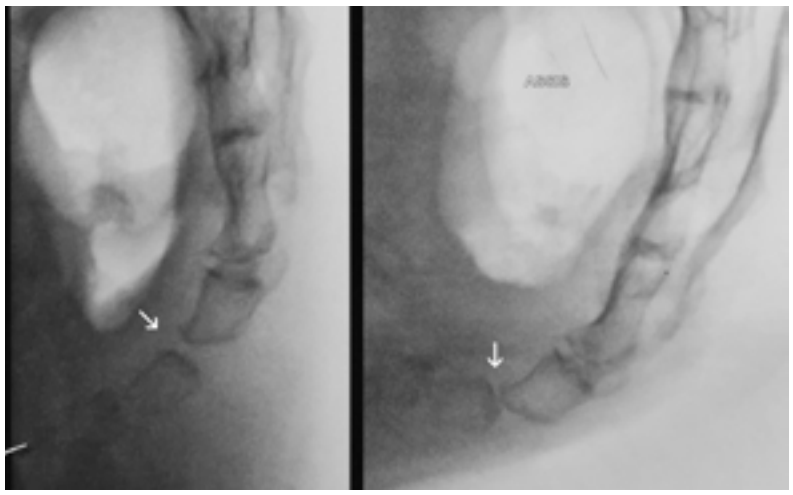

Figure 17. Normal mobility in flexion (sitting on right). C1-C2 disc narrowing in the sitting position, contact between two bone surfaces, and the presence of small osteophytes may indicate degenerative disc disease.

WHEN CAN WE FORGOT DYNAMIC FILMS?

The rule is that dynamic films should be taken for all cases of chronic coccygodynia (beyond 2 months), but there are a few exceptions. With the exception of pregnant women in whom it is obviously contraindicated, the most significant in practice is adolescents and young adults (under 20-25 years of age). Mobility abnormalities are very rare, and even non-existent, at this age. Therefore, unnecessary irradiation can be avoided, and the dynamic study can be replaced with magnetic resonance imaging of the coccyx (5). Cases where the coccyx is fully ossified on the standard film and therefore rigid also do not require dynamic study.

CONCLUSION

Information provided on dynamic films is of great significance for managing coccygodynia. They form the basis of all imaging of chronic coccygodynia in adults.

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