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The Impact of Coccydynia with Radiological Modality: A Systemic Review

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Introduction

Coccydynia, or Coccygodynia, is pain in the region of the Coccyx. Despite the identification of chronic coccygeal pain hundreds of yearsago, its treatment can be difficult and sometimes controversial because of the multifactorial nature of coccygeal pain.[1] Many Physiologic and psychological factors contribute to its etiology. Most cases of coccydynia resolve within weeks to months with or without conservative treatment, but for a few patients the pain can become chronic and debilitating.[2] Coccydynia is pain located in the coccygeal bone or the surrounding tissues. Coccydynia is a relatively rare condition, occurring more frequently in females and in all ages. Coccydynia is most frequently associated with single axis traumatic injury, childbirth, obesity, and rapid weight-loss related to gastric bypass surgery. There are several etiologies to the occurrence of secondary coccydynia, such as cancer pain, infection.[3] Chronic coccydynia is a condition for which there is limited understanding of the pathology. Patients may experience a marked loss in quality of life and difficulty in performing everyday activities. Coccydynia means ‘’ tail bone pain’’. This disorder can be manifested at any age but most common age is 40 years, ratio between male and female is 1:5. The well known risk factors of coccydynia are obesity, coccygeal sitting, child birth, constipation, tumor, infection, ant direct trauma and it can be idiopathic. The indication & advantages of manual therapy are not perfectly reported yet, because of lack of expertise & existence of variety of management.[4] Radiographs of the coccyx in different positions divide the coccydynia into four etiologic groups according to coccygeal mobility, subluxation, hyper mobility, hypo mobility & normal mobility.

Manual therapy consists of variety of techniques. This case report describes the successful management of chronic coccydynia by sacrococcygeal joint mobilization and soft tissue release. It will establish evidence of particular external manual therapy technique for management of coccydynia because of hypo mobile coccyx. This report will also help to physiotherapist to select appropriate manual therapy measure and avoid unnecessary use of other techniques and therapies. It also will avoid the hesitation in application of maneuver. The immediate selection of suitable therapy will reduce the disability and improve the quality of life.[5]

Anatomy

The coccyx is a triangular bone that consists of 3 to 5 fused segments, the largest of which articulates with the lowest sacral segment. The first coccygeal segment contains rudimentary articular processes called the coccygealcornua that articulate with the sacral cornua. These ligaments & muscles help support the pelvic floor and also contribute voluntary bowel control. In some cases, the joints are fused together. Certain types of coccygeal morphology also can lead to a predisposition to coccydynia. Despite its small size, the coccyx has several important functions. Along with being the insertion site for multiple muscles, ligaments and tendons, it also serves as one leg of the tripod along with the ischial tuberosities that provide weight-bearing support to a person in the seated position. Leaning back while in a seated position leads to increased pressure on the coccyx. The coccyx also provides positional support to the anus.[1] The coccyx articulates with the sacrum through a sacrococcygeal joint (including a fibrocartilaginous facet joints). The sacrococcygeal and intra-coccygeal joints allow for a modest amount of coccygeal movement, which is typically forward flexion while weight-bearing (sitting). The coccyx is a Greek word that means the beak of a cuckoo bird as the side view of the tailbone resembles the side view of a cuckoo birds beak. On the anterior surface of the coccyx, the following muscles gain attachment. Levator ani, iliococcygeus, coccygeus, & pubococcygeus. On the posterior coccygeal surface, the gluteus maximus is attached. Also attached to the coccyx ligaments, which are a continuation of the anterior and posterior longitudinal ligaments.[3] Bilateral attachments to the coccyx include the sacrotuberous and sacrospinous ligaments. Besides being an insertion site for these muscles and ligaments, which extends from the anus to the distal coccyx, holding the anus in its position within the pelvic floor. Functionally, a tripod is formed by the bilateral ischial tuberosities (at the right and left inferior buttock) and the coccyx (in the midline). This tripod supports weight- bearing in the seated position. The nerves of the coccyx include somatic nerve fibres and the ganglion impar, which is the terminal end of the paravertebral chain of the sympathetic nervous system.[6]

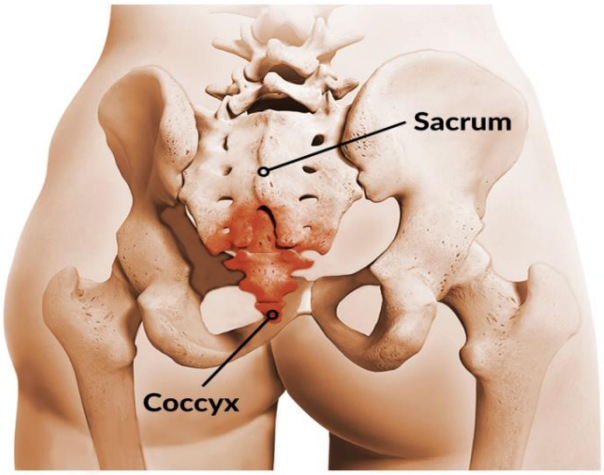

Figure. 1: Anatomy of lower vertebral column. Standing position

Presentation & Diagnosis of Coccydynia

Classical presentation of coccydynia is associated with pain, tenderness or an ache localized in the region of the lower sacrum, the coccyx, or in adjacent muscles and soft tissues. The pain becomes sharp during periods of sitting, when

getting up from a sitting position, during sexual intercourse, defection, & menstruation in females. The severity of the pain is dependent on various predisposing factors, such as the duration of time, spent sitting. The character of the pain appears to be more related to spasms of the levator muscle, Coccygeus muscle, & in the medial fibers of the gluteus maximus muscle.[1]

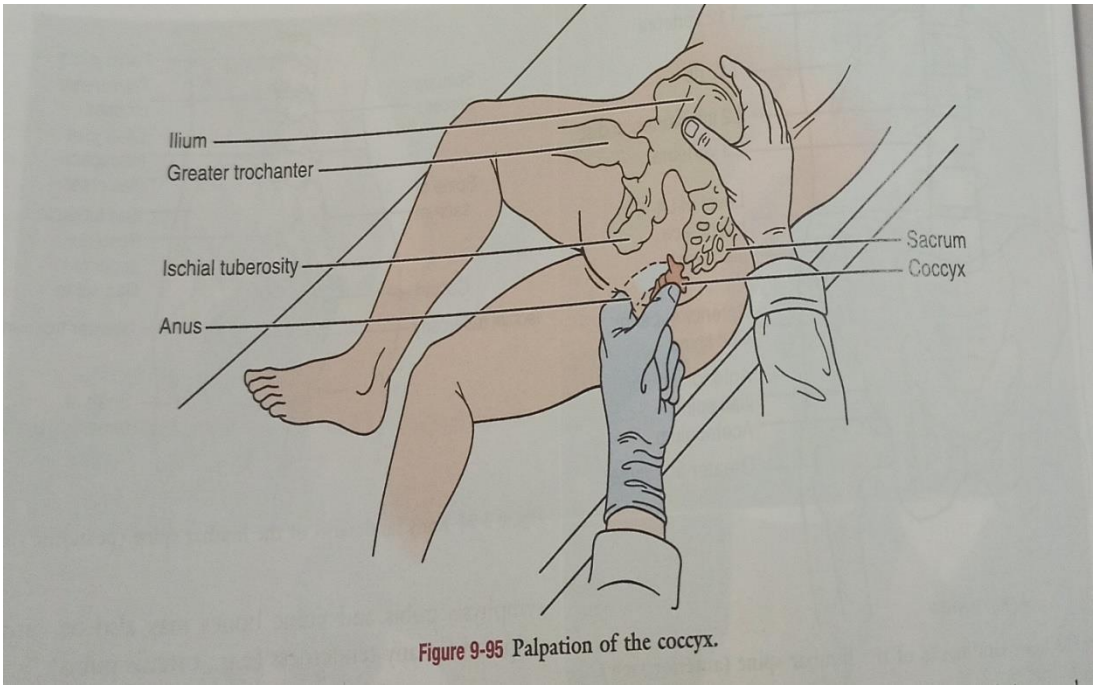

Figure-2: Palpation of the coccyx for assessing. Side lying position

Radiological Parameters

Dynamic radiographs were performed in all the cases and controls. The first radiograph was a standing lateral film. The second radiograph in cases was taken in the most painful sitting position. In controls, the second radiograph was taken after 1 min of sitting on a hard stool with back slightly extended position. The dynamic radiographs thus obtained were templated on to a transparent sheet and superimposed over a bright light source with both sacrum on top of each other to evaluate various radiological parameters. The intercoccygeal angle (ICA) used as a measure of the sagittal movement of the coccyx on dynamic radiographs, calculated as the angle between the two intercoccygeal lines drawn that pass in the center of coccyx (Figure 3).[15] The coccygeal angle of incidence also known as base angle (BA) is defined as the angle at which the coccyx strikes the seat when the subject is sitting down.[16] This angle is calculated between the standing intercoccygea line and the horizontal sitting surface. The angle of pelvic rotation (APR) is used to measure the sagittal rotation of the sacrum when the subject is sitting down in the most painful position.[15] In cases with subluxation, ICA, APR, and BA were not calculated as the intercoccygeal line could not be drawn.

Figure 3: (a) Intercoccygeal line drawn in standing (b) Intercoccygeal line drawn in sitting[15]

When dynamic radiography does not reveal the cause of pain, MRI may be performed to depict signal intensity alterations in or surrounding the coccyx, which may be related to the specific site of irritation. In rare instances, MRI may reveal unexpected disease of a more sinister nature. Additionally, coccyx morphology is better appreciated at MRI given its cross-sectional nature, along with better visibility of the terminal coccygeal segments, which typically are not seen well at radiography. Static imaging including radiographs, CT and MRI have been found to be inconclusive in a majority of patients with coccydynia.[21] Nevertheless, lateral and AP radiographs constitute an important primary investigation to rule out infections, tumors or predisposed coccygeal morphology such as retroverted coccyx, a bony spicule, coccygeal scoliosis or subluxation. (Figure.4). In cases of trauma, where radiographs are suggestive of a fracture or dislocation, a CT scan is recommended for definitive diagnosis. In patients with normal static imaging with radiographs and CT scans, dynamic imaging may be performed to rule out abnormal coccygeal mobility. Coccygeal mobility may also be evaluated by comparing erect lateral radiographs with supine MR films (Figure.5).

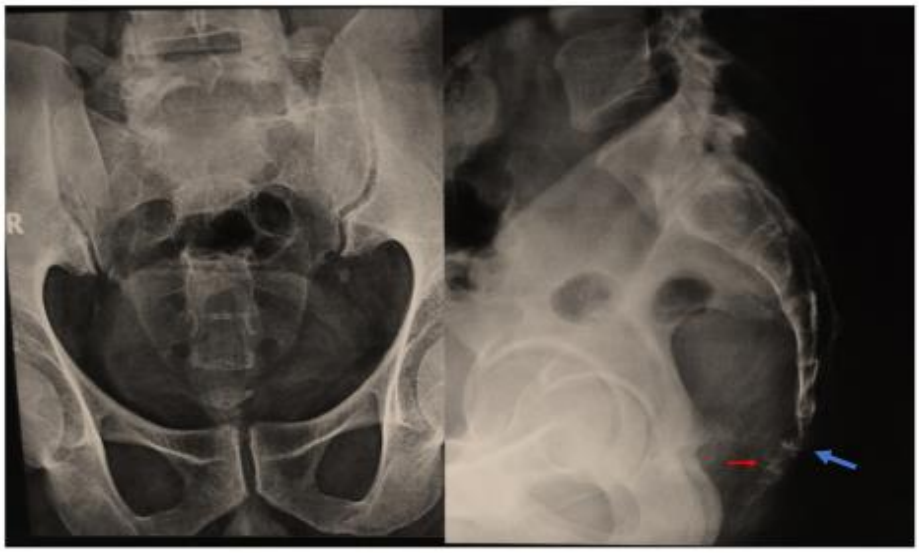

Figure 4: Anterio-posterior and lateral radiographs with post-traumatic double subluxation at sacro-coccygeal joints[21]

Figure 5: Coccygeal mobility assessment using standing radiograph(left) and supine MRI(right)[21]

Review of Literature

1. **Lesley et al.** conducted this study that "overview of Anatomy, Etiology & treatment of coccyx pain. The coccyx has several important functions. Along with being the insertion site for multiple muscles, ligaments, and tendons, it also serves as one leg of the tripod along with the ischial tuberosities that provide weight-bearing support to a person in the seated position. Results are showed that conservative treatment is successful in 90% of cases, and many cases resolve without medical treatment. Treatment for refractory cases include pelvic floor rehabilitation, manual manipulation and massage, transcutaneous electrical nerve stimulation, Psychotherapy, steroids injections, nerve block, spinal cord stimulation & surgical procedures. This study showed that a multidisciplinary approach adaptations, medications, injections and possibly psychotherapy leads to the greatest chance of success in patients with refractory coccyx pain."
2. **Gustav et al.** conducted this study "To evaluate the efficacy of available treatment options for patients with persistent coccydynia through a systemic review. Results are showed that the greatest improvement in pain was achieved by patients who underwent radiofrequency therapy (RFT, mean Visual Analog Scale (VAS) decreased by 5.11cm). This study showed that highlights the progressive nature of treatment for coccydynia, starting with non-invasive methods before considering coccygectomy. Non-surgical management provides pain relief for many patients. Coccygectomy is by far the most thoroughly investigated treatment option & may be beneficial for refractory cases."
3. **Bhavuk et al.** conducted this study " coccydynia is a disabling condition characterized by pain in the coccyx region of the spine. Treatment options for coccydynia include ergonomic adaptation, manual therapy, injections & surgery. This study concluded that patients with coccydynia suffer a lot of stigma due to ignorance of the underlying etiology & association of neurotic symptoms in some patients. The management of coccydynia should be carried out in a step-wise approach with increasing invasiveness. Finally, for resistant & recalcitrant cases, coccygectomy has shown excellent medium to long term outcomes."
4. **Ozlem et al.** conducted this study "To evaluate pain scores one year after impar ganglion block in patients with coccydynia who did not benefit from treatment. The medical records of 29 patients with coccydynia were reviewed. Demographic data, time to the onset of pain, causes of pain, X-ray findings, administered invasive procedures, & visual analog scale (pain) scores were recorded. Results are showed that, in 21 patients, the onset of pain was associated with trauma. This study concluded that the impar ganglion block provides effective analgesia without complications in patients with coccydynia. Pulse radiofrequency thermocoagulation combined with a diagnostic block prolongs the analgesic effect of the procedure. This study aimed was to evaluate pain scores in patients with coccydynia who underwent an impar ganglion block in algology department due to the failure of conservative treatment over the course of a 1- year follow up period."
5. **Lynn,et al.** conducted this study that " coccydynia refers to pain in the region of the tailbone. Most cases are related to mild injury, trauma & childbirth. The primary care provider will come across this complaint in a small portion of patients presenting with low back pain. There are no comprehensive guidelines for treatment of coccydynia. The diagnosis of coccydynia is made with a thorough history, physical examination & diagnostic imaging. Inspection is essential to

identify gross abnormality & to rule out other conditions. This study concluded that coccydynia is a common & often temporary condition that may be seen in the primary care office."

6. **Woon, et al.** conducted this study "Magnetic Resonance Imaging Morphology and Morphometry of the Coccyx in Coccydynia" They performed retrospective analysis and comparison of 112 computed tomographic scans from sex-matched people with normal coccyges and 107 persons (mean age, 43± 12 yr; 84 females) with clinically diagnosed coccydynia. They evaluated the bone spicule development, subluxation, sacrococcygeal and intercoccygeal joint fusion, angles, and curvature. According to their findings, when statistically significant coccygeal parameters were combined, the sensitivity, specificity, and positive predictive values in women were 72%, 71%, and 73%, respectively, while in men, the values were 52%, 92%, and 73%. They came to the conclusion that cross-sectional imaging provided the most extensive evaluation of coccygeal morphology and morphometry in adults with and without coccydynia.Anatomical variations in joint fusion and coccygeal curvature may either be associated with or contribute to the development of coccydynia.
7. **Samantha Dayawansa et al** conducted this study "Management of coccydynia in the absence of X-ray evidence: Case report". They endorsed a movable fragment that was not detected on plain film radiography and included a patient who suffered from coccygeal pain for three years. With MRI and CT evaluation, a coccygeal source of their discomfort was identified, and a partial coccygectomy was carried out. They came to the conclusion that the patient's post-operative pain had significantly improved at the time of her follow-up. In a case of suspected coccydynia where initial imaging is inconclusive but clinical suspicion is very high, higher-level imaging such as MRI or CT can reveal radiographic findings of coccydynia. In the absence of x-ray data, MRI and CT can be used to diagnose and treat coccydynia.
8. **A. Datir et al.** "CT-guided injection for ganglion impar blockade: a radiological approach to the management of coccydynia. The clinical history, the location of the pain, and the outcome of earlier diagnostic and therapeutic treatments were used to make the coccydynia diagnosis. Eight individuals underwent CT-guided ganglion impair blocks to relieve their coccyx discomfort when other treatments like oral medicine and cushions proved ineffective. All patients performed with ganglion impair blocks using a combination of bupivacaine and triamcinolone under the guidance of a thin-section CT scan. Six months were spent monitoring the patients. According to their study's findings, 11 injections were administered to eight participants during this trial. In every case, there was a technical success of 100%, with correct needle placement, no problems, and good patient compliance. Three of the eight patients (37%) who underwent follow-up visits for up to six months experienced total pain alleviation. Three of the eight patients (37%) experienced only partial symptom alleviation, necessitating the administration of a second repeat injection at the three-month mark of the follow-up period. Six out of eight patients (75%) had symptomatic alleviation at the conclusion of the 6-month follow-up period (four had full relief and two had partial relief) without continuing to use traditional pain relief methods. Two out of every eight patients, or 25%, experienced no symptomatic improvement. Prior to the surgery, the mean visual analogue score (VAS) was 8 (interval 6-10) and had dropped to 2 (interval 0-5) in six of eight patients. They came to the conclusion that ganglion

impar blocking can be performed using CT as an imaging technique to detect the ganglion. The benefits of CT-guided injection over those carried out under fluoroscopy may include precise and secure needle placement in the sacro-coccygeal region, simplicity of wide area coverage, decreased risk of complications from accidentally injecting into the major pelvic structures, and a higher chance of reaching the ganglion impar, especially in cases with anatomical variation in the location of the ganglion impar. These elements might affect how effective ganglion impar blockage is on the whole.

9. **Luigi Manfre et al** conducted this study "Coccygeoplasty: preliminary experience with this new alternative treatment of refractory coccydynia in patients with coccyx hypermobility" All patients who received CP for chronic coccydynia between January 2005 and October 2018 were analysed using a prospectively kept database. According to radiological imaging, all of the patients showed painful hypermobility (more than 25°) with anterior flexion. Using CT and MRI, alternative causes of coccydynia were ruled out. Under local anaesthesia, procedures were carried out under combination fluoroscopic and CT guidance. Three- and twelve-months following treatment, clinical follow-up was conducted using the Visual Analogue Scale (VAS). In one facility, twelve individuals received care. No difficulties with the procedure arose. The majority (75%) of patients had considerably lower VAS ratings than at baseline at 3- and 12-month follow-up, with mean reductions of 3.5 and 4.9, respectively. At 12 months, there was no recurrence of pain, and just one patient's pain did not get any better. In nine patients, further CT scans revealed that the sacrococcygeal bone segments had been fixed, however there was no link between the final imaging results and the clinical outcome (p=0.1). They came to the conclusion that patients receiving CP for painful coccyx subluxation and hypermobility had positive clinical outcomes at 3- and 12-month follow-up.
10. **Postacchini et al** "Idiopathic coccygodynia. Analysis of fifty-one operative cases and a radiographic study of the normal coccyx" In 120 asymptomatic volunteers, they examined the normal radiographic structure of the coccyx. In 51 patients who underwent partial or whole coccygectomy for idiopathic coccygodynia during a twenty-year period, they retrospectively reviewed the outcomes. The sacrococcygeal joint was fused in forty-four (37%) of the asymptomatic participants, the first intercoccygeal joint in twelve (10%), and the second intercoccygeal joint in fifty-two (43%) of them. On the lateral radiographs, the coccyx could be seen in four different configurations. The coccyx in Type I was slightly bent forward, whereas in Type II the curve was more pronounced and pointed straight ahead. The coccyx was angulated sharply forward in Type III, and it was subluxated at the sacrococcygeal or intercoccygeal joint in Type IV. 68% of the individuals had a Type-I setup. The sacrococcygeal joint fusion was present in twenty-six (51%) of the fifty-one individuals with idiopathic coccygodynia, six (12%) of the first intercoccygeal joint, and twenty-five (49%) of the second intercoccygeal joint. The Type-I, Type-II, Type-III, or Type-IV configuration of the coccyx was present in 69% of individuals. The extent of the coccygectomy in the remaining eight patients' cases could not be identified, while 31 patients had undergone a partial coccygectomy and 12 had a complete coccygectomy. Of the 36 patients who were followed for at least two years, 32 (88%) had excellent or good surgical outcomes.
11. **Ahmed Y. Soliman et al.** "Coccygectomy for refractory coccydynia: A single-center experience" It is a retrospective study that was carried out from 2016 to 2019 on 14

patients who had refractory coccydynia and had failed conservative treatment for at least six months prior to surgery. Their study's findings indicate that, of the 14 instances, 13 (92.86%) were female and one (7.14%) was male. 5 instances (35.71%) were idiopathic, while 9 cases (64.29%) were trauma-related. When compared to preoperative VAS, the visual analogue scale (VAS) was significantly lower at 1, 3, and 6 months postoperatively, as well as at the end of the trial. Six cases (35.71%) had complete relief from preoperative discomfort (VAS = 0), seven cases (50%) had improvement (VAS 4), and just one instance (7.14%) had a VAS drop from eight to six.85.72% of all instances had complete satisfaction, 7.14 % had some satisfaction, and 7.14 % had no opinion. One patient experienced wound dehiscence after surgery, while another experienced localised wound infection. They came to the conclusion that the coccygectomy is a minimally invasive surgical procedure that effectively relieves pain in patients with refractory coccydynia.

12. **Maigne et al** "Idiopathic Coccygodynia Lateral Roentgenograms in the Sitting Position and Coccygeal Discography" 51 coccydynia patients and 51 controls participated in dynamic research. Graph paper with a double reading was superimposed to measure coccygeal movement. The measurement's accuracy was 2.6°, with intra- and interobserver variances of 15.3 and 12.5%. The patient group underwent coccygeal discography after this dynamic examination. 25 patients had aberrant movement (luxation or hypermobility) of the coccyx that occurred when they were seated and spontaneously reduced when they were in the lateral decubitus position. Such lesions could be responsible for the pain because no similar findings were seen in the controls and cocygeal discography was positive in these cases. Coccygeal discography, using a combination of provocation and anaesthesia, was successful in 15 of 21 of the 26 patients with a normal dynamic study. They came to the conclusion that in about 70% of cases, common coccygeal pain could originate from the coccygeal disc.
13. **Dave et al** "A Clinical and Radiological Study of Nontraumatic Coccygodynia in Indian Population" Between June 2015 and May 2017, a total of 46 nontraumatic coccygodynia cases and 46 controls who satisfied the inclusion criteria were assessed using dynamic radiography. To determine the radiological lesion in cases, radiological measures including coccyx sagittal movement, intercoccygeal angle (ICA), base angle (BA), and angle of pelvic rotation (APR) were determined and compared between cases and controls. For these individuals, a recommended therapy protocol was based on clinico-radiological data. There were 46 cases and 46 controls evaluated in all. In cases, the mean age was 41.8 years, whereas in controls, it was 40.6 years. The BMI scale ranged from 19 to 33. In 29 cases, the BMI was over 25. At the initial presentation, the average visual analogue scale score was 6.9; at the 6-week mark, it was 4.7; and at the last follow-up, it was 3.9. ICA varied from 1 to 21 degrees (mean 11.12 degrees). BA has a range of 0 to 83 (mean 41.41) degrees. APR ranged from 2° to 33° (mean 14.74°). While nine cases required coccygectomy, twenty-seven patients experienced good relief after local hydrocortisone injection and massage. They came to the conclusion that dynamic radiographs are useful for identifying radiological criteria and treatment planning. Patients with nontraumatic coccygodynia exhibit sagittal movement of extension, posterior subluxation, increased BA, and low APR on radiographic examination.
14. **Mahmoud M. et al** conducted this study "Radiological and Magnetic Resonance

Imaging of idiopathic Coccydynia and Study of the Effect of Prolotherapy" Patients with coccydynia who had been clinically diagnosed underwent thirty coccyx magnetic resonance tests. Their median age was 35.9 + 7.12 (interquartile range: 19–50). They were examined and compared with 30 images from adults with normal coccyxes who were matched for sex. Every patient with coccydynia had a local injection around the coccyx (8 ml of 25% dextrose and 2 ml of 2% lignocaine). Compared to controls, Patients with coccydynia had significantly higher levels of coccygeal type 2 (P=0.003), sacrococcygeal joint fusion (P=0.02), bony spicule (P=.01), intercoccygeal subluxation (P=.007), significantly lower levels of coccygeal curvature index (P=0.04), sacral angel (P=0.01), and intercoccygeal angel (P=0.04), extremely significant greater sacrococcygeal curved length (p = 0.001) and less sacrococcygeal curvature index (p = 0.001) The mean VAS following a six-month follow-up significantly differed from the preinjection VAS (P=.04). Only five (16.6%) patients had bad results, whereas seventeen (56.7%) had excellent results and eight (26.7%) had good results. Intercoccygeal subluxation, coccygeal spure, and enlarged coccygeal curve may be predisposing variables of idiopathic coccydynia, according to a comparison of MRI of coccydynia patients and controls. After a six-month follow-up, they came to the conclusion that prolotherapy significantly improved pain and daily living activities.

15. **Ferhat et al.**Morphometric Evaluation of Coccyx with Microcomputed Tomography (Micro CT) and Computed Tomography (CT) Technology: Twenty embalmed cadaver coccyges were investigated using a micro CT machine. It was securely removed the inferior portion of the sacrum, coccyx, and surrounding soft tissue. All parameters were measured using micro CT image viewer programmes after the tissue was scanned by a micro CT equipment. 29 patients without coccyx pathology had their CT scans evaluated using OsiriX software. Utilising statistical techniques, the micro CT and CT-measured morphometric parameters were assessed. In general, males had bigger mean values for the morphometric parameters than did girls. When comparing CT and micro CT images, the mean values for vertical length and coccyx breadth were higher for CT. In the frontal plane, the coccyx was flatter in females. Regarding the mean vertical length, width, lateral deviation angle, and sacrococcygeal angle and length of the vertebrae, there were statistically significant changes between the micro CT and CT images (p 0.05). The number and width of the vertebrae did not differ statistically significantly (p > 0.05). They came to the conclusion that looking at the typical coccyx morphology would aid in understanding and treating the pathologic diseases of the coccyx.

Conclusion

In conclusion, evaluation of normal coccygeal morphology helps to better understand the pathologic conditions of the coccyx. We believe our findings will contribute to the data related to the coccyx anatomy and thence novel clinical techniques and treatment strategies in the management of coccygeal pathologies. Dynamic radiographs help in defining the radiological parameters and planning treatment. Understanding the dynamic nature of coccydynia and its relevant anatomy is important for accurate assessment of potential abnormalities. The suggested imaging work-up includes dynamic radiography with CT in acute trauma and MRI when dynamic radiography does not depict a cause. Awareness of subtle imaging findings and differential considerations that are associated with coccydynia improves the radiologist's role in consulting on these often difficult cases. The radiologist can play a central role in providing pain management

in patients with chronic coccydynia with minimally invasive image-guided procedures.The present study documented that, impact of coccydynia with radiological modality. how it will depend on Radiological modality.

Physiotherapeutic assess & therapeutic treatment much needed as well as radiological findings and radiologist also plays a vital role by their imaging findings.

The present study documented that, impact of coccydynia with radiological modality. How it will depend on radiological modality. Physiotherapeutic assess & therapeutic treatment much needed as well as radiological findings and radiologist also plays a vital role by their imaging findings & awareness the patient with chronic coccydynia. Further study, we are finding more need able information about present study.

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