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Changes In The Angles Of Coccyx As A Causative Factor For Idiopathic Coccydynia - A Retrospective Study.

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ABSTRACT
Coccydynia is a pain around the coccyx exacerbated on sitting. Massobrio and Postacchini suggested the morphology of the coccyx as a causative role for coccydynia. Massobrio and Nathan proposed the etiology of coccydynia based on the classification of coccyx morphology based on the Sacrococcygeal angle. Though CT and MRI fail to determine the causation of idiopathic coccydynia being static, dynamic X-rays in standing and sitting positions . Immobility or hypermobility are marked cases for being so. In this study we hypothesize the proprioceptive changes that might occur on dynamization of the sacro and Intercoccygeal angles in 99 subjects between 20-60 years both male and female with idiopathic coccydynia . Having done a longitudinal retrospective study through statistical analysis there were significant changes in both the angles ($p<0.00001$). To conclude significant changes in Sacrococcygeal and Intercoccygeal angles with intervention on the filum terminale is a significant cause of coccydynia.

Key words: *Idiopathic coccydynia; coccyx morphology; Sacrococcygeal angle; Intercoccygeal angle; filum terminale.*

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I. INTRODUCTION

Coccyx is a conical, distal-most section of the spine, usually consisting of 3-4 segments. Although the sacrococcygeal junction may rarely fuse, it usually remains mobile for life [1,2]. The coccyx derives its name from the ancient Greek for the similarity of the terminal portion of the spine to the beak of a cuckoo[4,5,6] The coccyx is a triangular bone consisting of three to five segments: the first and largest of these vertebral segments articulates with the sacrum. The last three segments diminish in size and usually form a single piece of bone.

Coccydynia was first used by Simpson in 1859 to describe pain surrounding the coccyx exacerbated by sitting [1-3]. Its etiology includes sitting for long periods of time, falling, traumas that may occur during birth or spinal surgery, and less frequently, chordoma, intraductal schwannoma, perineural cysts, giant-cell tumor, and intraosseous lipoma. However, cases where the cause is not found are also quite frequent [1-3]. It has been reported that the morphological and pathoanomical features of the coccyx are important in the development of coccydynia.Clinical studies use the Postacchini- Massobrio classification, which is based on the angle of the sagittal plane between the sacrum and the coccyx, and revised in 2010 by Nathan et al [Table I] to assess the coccyx.[7]. Postacchini and Massobrio[7] suggested that the morphology of the coccyx may have a role in the aetiology of coccydynia. Modification of their classification to incorporate retroversion and scoliosis of the coccyx [Table I], (Fig.1). Based on the classification of morphology, type II, III and IV patients were at higher risk of developing coccydynia.

The diagnosis of coccydynia was based predominantly on clinical examination with static standard radiographs, CT, and routine blood tests, which showed no particular abnormality except in the presence of tumour or infection. It has been reported that some anatomical and morphological changes may cause pain when people with coccydynia are compared to the normal population[7] Coccydynia is a dynamic disorder which can only be appreciated on dynamic films. Static MRI failed to identify the cause of coccydynia, as it is a dynamic disorder. Coccydynia is commonly associated with coccygeal displacement, immobility (<5° of movement), or hypermobility (>25° of movement).[8,9]

The filum terminale externum tethers the thecal sac distally to the sacrococcygeal region (Fig 2). This structure could be a source of traction on or irritation of the thecal sac with an angulated coccyx or coccygeal

injury and may be transected to treat a tethered cord [10].

II. AIM OF STUDY

We hypothsise that propriceptive changes following stretching of the sacrococcygeal and or intercoccygeal angles lead to stimulation of the Filum terminale externum and pelvic diaphragm leads to coccydynia.

III. METHODS

Our sudy was desgined rerospective longiudinally, in the age group of 20-60 years , (mean= 38.9 years). From the lateral radiographs, the examiner assessed the intercoccygeal angle and sacrococcygeal angle[11] both in standing and sitting [Fig 3 and 4] [12][Table 2], [Table 3].

By comparing the coccyx position while sitting versus standing,we objectively measured the changes in the coccygeal angle (amount of flexion) and luxation (amount of listhesis at each of the coccygeal joints). The normal range of coccygeal mobility is between 5 and 20 degrees.[11,12,13] and Sacrococcygeal angle. Dr. A.C. calculated from the differences in intercoccygeal and Sacrococcygeal angles in 160 x-rays. Then the data was correlated with the records of the xray registration numbers by Dr. S.R. A total of 99 subjects (65 female and 34 male between the age group of 20-60 years) were found to have idiopathic Coccydynia. Exclusion factors were records of trauma, inflammation, tumour, surrounding soft tissue inflammation, BMI less than 25 and more than 30, associated gross morbidities, history of surgery around the assessed region, post partum of one years, BMD score >-2.5 as T score of AP spine.Degrees of intercoccygeal angle in the different types was arrived from this reference [18,19] and sacrococcygeal angle was arrived from this reference[Table 3] [16,17].The types of coccyx angulation according to modified Postacchini- Massobrio classification, the intercoccygeal angle, the sacrococcygeal angle, and coccydynial pain in NRS scale are tabulated and statistical analysed. All the data were tabulated in Microsoft office Excel sheet and statistical analysis done .Pain measured in Numerical Rating scale[16]

STATISTICAL ANALYSIS

Data were statistically analyzed using IBM SPSS version 20.0. (Armonk, NY: IBM Corp).
Descriptive statistics included number (n), mean ($\bar{x}$), and standard deviation (SD).

Qualitative data were reported as (n) and were analyzed using Chi-square test, when appropriate. Quantitative variables were reported as ($\bar{x}$) and (SD), and were compared using Student's t-test when comparing 2 groups and ANOVA test when comparing more than 2 groups. Levenne's test to assess the equality of variances and normality assumption by Shapiro - Wilk's test. Kruskall- Walli's test for validation of the null hypothesis. A P-value of less than 0.05 was considered statistically significant.

IV. RESULTS

ICAs-ICA andSCAs-SCA NRS The chi-square statistic is 584.3967. The p-value is <0.00001. Significant at p <.05.ICAs-ICA and SCAs-SCA NRS The chi-square statistic with Yates correction is 583.5945. The p-value is <0.00001. Significant at p <.05. ICAs-ICA and SCAs-SCA NRS The t-value is -13.89128. The p-value is <.00001. The result is significant at p <.05.Age with ICAs-ICA with SCAs-SCA with NRS Sitting vs standing ANOVA results The f-ratio value is 320.60478. The p-value is <.00001. The result is significant at p <.05. Tuskey HSD for the same (pairwise comparison) gives significant Q values and significant pvalues<0.0001.Levenne's test between ICAs-ICA and NRS diff The f-ratio value is 67.28994. The p-value is <.00001. The result is significant at p <.05. Levenne's test between SCAs-SCA and NRS diff The f-ratio value is 0. The p-value is .999999. The result is not significant at p <.05. The requirement of homogeneity is met.

The Shapiro-Wilk test for ICAs-ICA showed a significant departure from normality, W(99) = .93, p <.001. The Shapiro-Wilk test for SCAs-SCA showed a significant departure from normality, W(99) = .97, p = .016. The Shapiro-Wilk test for difference in pain in sitting and standing showed a significant departure from normality, W(99) = .97, p = .016.

V. DISCUSSION

Coccydynia, or coccygodynia, is pain in the region of the coccyx. 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.

Classification of coccydynia based on aetiology
A: Based on aetiology[21,22]
1. Idiopathic [7]

2. Traumatic

B: Based on pathology
1. Degeneration of the sacrococcygeal and intercoccygeal disc and joints
2. Morphology of the coccyx: type II, III, IV, presence of a bony spicule and coccygeal retroversion
3. Mobility of the coccyx: hypermobile or posterior subluxation
4. Referred pain: lumbar pathology or arachnoiditis of the sacral nerve roots, spasm of the pelvic floor muscles and inflammation of the pericoccygeal soft tissues
5. Others: neoplasm, crystal deposits, infections

C: Somatisation or neurotic

The coccyx is a triangular bone that consists of 3 to 5 fused segments, the largest of which articulates with the lowest sacral segment. In addition, the first coccygeal segment contains rudimentary articular processes called the coccygeal cornua that articulate with the sacral cornua. The lower part of the filum terminale, also called the coccygeal ligament, inserts onto this first segment.Certain types of coccygeal morphology also can lead to a predisposition to coccydynia. Imaging studies, including dynamic x-ray and magnetic resonance imaging, can help diagnose sacrococcygeal joint hypermobility or hypomobility.

Conservative treatment is successful in 90% of cases, and many cases resolve without medical treatment.[6,23,24,25]

In our series we reviewed records where the differences in sacrococcygeal and intercoccygeal angles in both males and females in standing and sitting positions were gathered statistically corroborating with the coccydynial pain difference in those two postures which were found to be significant ($p<0.0001$)

VI. CONCLUSION

Changes of the sacrococcygeal and or intercoccygeal angles supposedly lead to stimulation of the Filum terminale externum passing along the same site and the proprioceptive reception changes this leading to coccydynia. This is confirmed by statistical analysis of the difference between Sacrococcygeal angle in sitting vs Sacrococcygeal angle in standing positions also the difference between Intercoccygeal angle in sitting and standing positions.

Ethics Committee Approval:
Conflict of Interest: None declared.
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