

## Radiographic Evaluation and Triple Pelvic Osteotomy for the Treatment of Immature Canine Hip Dysplasia

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### 어린 개 고관절 이형성의 방사선 평가 및 3중 골반골 절단술에 의한 치료

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**요 약 :** 8개월령의 체중이 40.4 kg인 로트와일러 수컷 어린개와 9개월령의 체중 34.6 kg인 골든 레트리버 수컷 어린개가 각각 2주령과 1개월령부터 파행 및 통증을 주증으로 머독대학 동물 병원에 내원 하였다. 내원 했을 때 호흡과 심박수 및 체온은 정상이었다. 일반 보행 및 신경검사와 방사선 사진을 촬영하여 확인한 결과 양측 고관절 이형성(Hip dysplasia)과 퇴행성 관절질환(Degenerative joint disease)을 확인 할 수 있었으며, 그 증상의 정도는 우측에 비하여 좌측이 더 심하게 나타났다. 외과적 치료는 Slocum과 Devine에 의한 3중 고관절 절단술(Triple pelvic osteotomy)를 실시하였으며 특별한 외부 교정은 하지 않았다. 수술 후 5개월 동안 지켜본 결과 증상은 매우 좋아졌으며 골반골의 완벽한 고정 유지에 따른 교정된 고관절을 확인 할 수 있었다.

**Key words :** triple pelvic osteotomy, hip dysplasia, immature dog

### Introduction

Canine hip dysplasia is a hereditary developmental disease, which is initiated by coxofemoral laxity in the growing dog<sup>7,12,20</sup>. Joint incongruity creates abnormal forces within the developing hip joint and can lead to degenerative joint disease. This complex disease is influenced by multiple factors which are often interrelated, such as genetic, growth, morphology, exercise and nutrition<sup>1,6,10</sup>. Different treatments can be proposed depending on the clinical signs, degenerative joint disease, age and weight of the animal and financial means of the owners<sup>3,16,22</sup>. The efficacy of some treatments is still controversial. Excision arthroplasty of the femoral head and neck results in the formation of false fibrous articulation<sup>21,18</sup>. The hip movement is abnormal and different degrees of lameness should be expected. Joint incongruence

in the immature animal produces abnormal forces within the developing hip joint that lead to articular cartilage degeneration<sup>20</sup>. Triple pelvic osteotomy is performed in young dogs to reposition the acetabulum in an attempt establish joint congruence and minimize degenerative changes<sup>23,24</sup>.

In this paper, I describe the successful treatment of hip dysplasia in two immature large breed dogs by triple pelvic osteotomy.

### Materials and Methods

The study was radiographic evaluation and two large breed immature dogs with hip dysplasia were treated at Murdoch University Veterinary Hospital by a triple pelvic osteotomy.

#### Dog 1

A 8-month-old, body weight 40.4 kg, intact male Rottweiler presented with a 2-week history of lame-

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ness and pain following a light walk, throwing out left forelimb and rotating his hip when walking.

On physical examination, the dog was presented the predominant clinical sign was lameness in the left hindlimb and pain on manipulation of the left hip. The stance and gait involved significant hyperextension of both the left stifle, hock and external rotation of the left hind foot. The forelimbs were unremarkable on palpation.

Radiographic findings (Fig 1): The dog was anaesthetized and radiography performed. Lateral, flexed lateral radiography of left forelimb were not gross lesions and the elbows appeared to have not sign of elbow dysplasia. Extended ventrodorsal radiography of the pelvis was indeed some very mild secondary arthritic change in the hip joints but interestingly there was also evidence of irregularity around the growth plates of both the proximal and distal femur. In the right coxofemoral joint was evidence of mild hip dysplasia. Only approximately two thirds of the femoral head was covered by acetabulum thus there was a mild degree of subluxation and increased in medial joint space. In the left coxofemoral joint

only one third of the femoral head was within the acetabulum, thus there was moderate to marked hip dysplasia or subluxation of coxofemoral joint. There was a significant increase in joint space so much so that the mid-point or center of the head of the femur was situated lateral to the dorsal acetabular ridge. Also on the left side there was a mild degree of cranial flaring of cranial acetabular edge and rounding of the cranial effective acetabular rim. Both femoral necks have mottled, irregular radio-opaque lines running through them which appeared to correspond to the metaphysis. The femoral neck also has a very faint Morgan's line developing around the area of joint capsule attachment. A diagnosis of the left hip dysplasia with mild degenerative joint disease was made.

I discussed all of the various options for treatment of hip dysplasia with owners and they elected for a triple pelvic osteotomy which was performed on the left hip.

#### Dog 2

A 9-month-old, body weight 34.6 kg, castrated

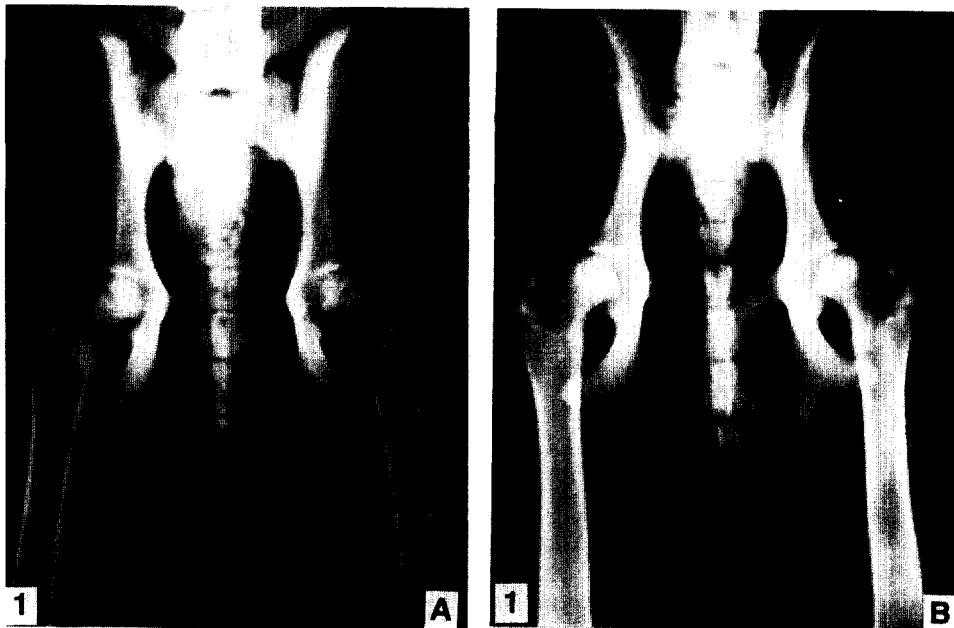


Fig 1. Pre-operative ventrodorsal radiograph of the hip joints showing subluxation and poor congruence (A; Dog 1, B; Dog 2).

male Golden Retriever presented with a 1-month history of lameness and pain following exercise and suspected valgus deformity of the forelimbs.

Physical examination of the dog on presentation revealed a slight external rotation of both forelimbs resulting in an appearance of valgus deformity. However, there was no actual angular deformity caused by growth plate disturbance, this slight external rotation being a compensation for a combination of both left fore and left hindlimb lameness. The right elbow joint was normal. The left hip joint was readily subluxated with the dog in a standing position and could be palpated as subluxating when the dog was walking.

Radiographic findings (Fig 1): Lateral, flexed lateral radiography of left elbow indicated moderate degree of osteoarthritis with no evidence of osteochondritis. The most likely cause of this osteoarthritis was fragmented coronoid process. Extended ventrodorsal radiography of the pelvis was bilateral subluxation of the femoral head. The left femoral head

was most severely affected and lies 4 mm lateral to the dorsal rim, the left approximately 2 mm. There was bilateral flaring of the cranial acetabular edge, the left almost showing bilabiation. Bilateral remodelling changes to the head and neck of the femur were also present. The femoral neck appears thickened and a band of exostosis could be seen on the right femoral neck as a Morgan line, and as a thickened radiopaque band on the left femoral neck. These radiography revealed severe bilateral hip dysplasia with the left hip being worse than right and early signs of osteoarthritis evident in both hip. Ortolani testing was done and revealed angles of reduction and subluxation between 30 and 35° on the right hip.

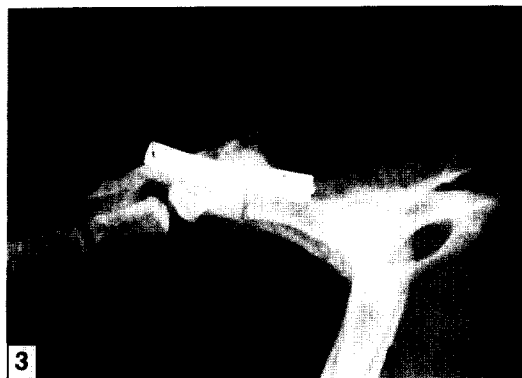
I discussed the various options for treatment of the hip problem, these being triple pelvic osteotomy to try to improve function and minimize osteoarthritis in the joint, femoral head and neck excision, conservative therapy and total hip replacement. The owners chose to go with the triple pelvic osteotomy route.

### Surgical procedure

The dogs were sedated with oxymorphone (0.1 mg/kg Intramuscularly; IM) and acetylpromazine (0.05 mg/kg IM). Anesthesia was induced by intravenous injection of thiopental (10 mg/kg) and maintained with inhalation of halothane and oxygen. An epidu-



**Fig 2.** Ventrrodorsal radiograph of the hip joints immediately after triple pelvic osteotomy. There is a significant improvement in joint congruence on the treated side (Dog 1).



**Fig 3.** A postoperative lateral radiograph of a pelvis showing the pelvic, the ischial osteotomy, and the plate on the ilium (Dog 1).

ral injection of morphine (0.1 mg/kg) was administered before surgery. A decision was made to perform a triple pelvic osteotomy with axial rotation of the acetabulum, as described by Slocum and Devine<sup>24,25</sup>. The procedure was performed in three stages. First the pubis was osteotomized through a ventral approach and using an oscillating bone saw. The second surgical procedure was osteotomy of the tuber ischii. This osteotomy could be made with a Gigli wire, but an osteotome should not be used as the pelvis will split incorrectly. The third surgical procedure was osteotomy of the ilium. In preparation for the ilial osteotomy, a blunt Steinmann pin was placed through the ischial incision immediately dorsal to the eminence of the ischiatic tuberosity. A five-hole 3.5 dynamic compression plate was selected and this was reangled from 45° to 30° as was required. The ilium was osteotomized at right angle to the alignment of the Steinmann pin, and just caudal to the sacrum, with oscillating saw. This allowed movement of the acetabular segment, which was rotated to its new an-

gle of 30°. The centered plate was fixed to the ilium with 5 screw. The wound closure was routine. At the end of surgery there was no palpable laxity of the left hip. Dexamethasone was administered at 1 mg/kg daily for seven days, then reduced to tapering doses over the next seven days.

### Prognosis and follow-up

On the second day the dogs were walking exceptionally well on the operated leg. They have been sent homes with orders for very strict confinement and rest over the next 4 weeks and they will have a further radiograph 4 weeks post-operatively to ensure that healing are progressing well. Further radiographs were taken five months after the operation which showed bone healing were progressing well. The dogs were able to run and play normally.

### Discussion

The triple pelvic osteotomy with axial rotation of the acetabulum to stabilize the femoral head within the acetabulum in a functional position is an effective method of treating hip dysplasia. The relationship of form and function is used to promote a more normal development of the hip with the hope of preventing rather than accepting the inevitability of degenerative joint disease<sup>5,13</sup>. After surgery, all hips in the dogs of this study remained stable, most remained nonpainful, and no evidence of degenerative joint disease as determined by radiography. Triple pelvic osteotomy can be performed in skeletally immature dogs, whereas total hip replacement is often not indicated in these dogs.

There are disadvantages and problems associated with osteotomy of the pelvis as a treatment for hip dysplasia<sup>9,11,15</sup>. The surgical procedure takes more time to perform and requires more equipment than would be necessary for femoral head and neck excision arthroplasty. In light-weight dogs with hip dysplasia, femoral head and neck excision arthroplasty is a practical alternative to triple pelvic osteotomy<sup>14,19</sup>. Theoretically, the operation should be done early, most commonly between 4 and 8 months of age, in order



**Fig 4.** Ventrrodorsal radiograph of the hip joints 5 months after triple pelvic osteotomy. Additional improvement in joints congruence has occurred in the 5 months since surgery (Dog 1).

to take advantage of the remodeling capacity of immature bone. With instability and subluxation over a period of time, the acetabulum becomes filled with osteophytes and new bone that covers the original surface, thus preventing congruency between the femoral head and acetabulum<sup>4,8</sup>. These changes become increasingly severe by the age of 10 to 12 months<sup>3,7</sup>. In these cases, the dogs were recorded weigh 40.4 kg, 34.6 kg and age 8 month, 9month respectively. Two surgical techniques have emerged in recent years, the triple pelvic osteotomies of Schrader<sup>22,23</sup> and Slocum<sup>24,25</sup>. Slocum has devised a bone plate for this procedure, using 3.5 mm screws, which is made in three angles of rotation: a 20-degree plate with a fixed angle; a 30-degree plate that can be twisted to angles between 20 and 40 degrees; and 45-degree plate that can be molded between 35 and 60 degrees<sup>21,24</sup>. In dogs of this report, the five hole plate was selected and this was reangled from 45 to 30 degree as was required, as described by Slocum and Devine<sup>25</sup>. A prerequisite of surgery is that one must be able to reduce the hip when the dog is under general anesthesia. In some instances, it might be difficult to feel the femoral head seat within the acetabulum during reduction. In dogs of this report, the character of Ortolani's sign (a reduction sign) did not always correlate with the degree of radiographic subluxation. Ortolani's sign was more difficult to elicit when the joint capsule was thickened, the ligament of the femoral head was redundant, the floor of the acetabulum was filled with fibrous tissue, and when the rim of the acetabulum was flattened. In dogs of this report, femoral osteotomy was not necessary to obtain a satisfactory outcome; however, there was a tendency for the functional result to be less satisfactory in dogs having the largest angles of femoral anteversion. Repositioning the acetabulum is facilitated by elevation of soft tissues from the medial aspect of the acetabular fragment. One should not allow the caudal portion of the fragment to be displaced medial to the remaining intact portion of the ischium because this attenuates the pelvic canal and the ischium tends to block rotation of the acetabular fragment. The angle of the ilial osteotomy is critical in attaining the desir-

ed amount of rotation. An oscillating bone saw should be used to obtain an accurate cut. I prefer plate and screw fixation of the ilium because it was adequate in these cases.

In the case reported herein the dogs made steady progress to the point that it was able to lead a functional lifestyle. The surgical results of in this and previous cases indicate that the triple pelvic osteotomy is an effective method of treating moderate-to severe subluxation of the hip in young, growing dogs with hip dysplasia.

## Conclusion

The 8-month-old, body weight 40.4 kg, intact male Rottweiler and 9-month-old, body weight 34.6 kg, castrated male Golden Retriever were presented with a 2-week history of lameness following a light walk, throwing out left forelimb and rotating his hip when walking and with a 1-month history of lameness following exercise and suspected valgus deformity of the forelimbs respectively. On physical examination, the dogs were presented the predominant clinical signs were lameness in the left hindlimb and pain on manipulation of the left hip. Extended ventrodorsal radiography of the pelvis were indeed some mild secondary arthritic change in the hip joints. In the left coxofemoral joint only one third of the femoral head was within the acetabulum, thus there was moderate to marked hip dysplasia. The triple pelvic osteotomy were achieved with Slocum and Devine's surgical method. Five months postoperative the patients had improved and hip joints were complete.

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