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Total Hip Replacement for Treatment of Chronic Coxofemoral Joint Dislocation in 7 Dogs

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Abstract : Total Hip Replacement in a patient with chronic coxofemoral joint dislocation is a challenging problem because chronic coxofemoral joint dislocation causes severe morphological changes. These challenging factors make surgery more difficult and increase the possibility of postoperative complications including cup implant dislocation and prosthetic joint luxation. All patients were diagnosed having at least 2 months of coxofemoral joint dislocation. On physical examination, crepitus was noted in the coxofemoral joint. Radiographs revealed hip joint dislocation with mild to severe degenerative changes. Total hip replacement was planned for all patients. Dorsal acetabular rim deficiency in 3 cases was augmented using a locking plate and polymethylmethacrylate bone cement. All cases have shown difficulty in prosthetic joint reduction. Pectineus and rectus femoris muscle origin were released in all cases. At 12 months follow up, all patients showed satisfactory ambulation. The issues on perioperative prosthetic joint reduction and luxation due to chronic coxofemoral joint luxation with muscle contracture and dorsal acetabular rim deficiency can be resolved by muscle releasing and dorsal acetabular rim augmentation.

Key words **:** total hip replacement, dislocation, dorsal acetabular rim deficiency, augmentation, muscle releasing.

Introduction

Canine hip dysplasia (CHD) is a common congenital disorder of the coxofemoral joint in which laxity of the joint leads to degeneration of articular cartilage and development of osteoarthritis (8). Chronic CHD with secondary osteoarthritis may result in considerable morphological changes. These including, dorsal acetabular rim (DAR) erosion, lateral drift of the proximalmedial femoral cortex, medialization of the greater trochanter, sclerosis of the proximal aspect of the femoral medullary canal and muscle atrophy including contracture of the hip musculature muscles (1). From among these, DAR erosion and muscle contracture could make total hip replacement (THR) surgery more challenging and increase the possibility of postoperative complications. A chronically dislocated femoral head can erode the DAR, resulting in decreased dorsal acetabular bone stock. Poor quality of DAR may lead to failure of the cup implant because the loading of a cup is inadequately supported by bone (2). In more severe case, coxofemoral joint can be thoroughly dislocated without any obvious trauma and causes deviation of the distance between the muscle origin and insertion. Deviation of muscles leads to muscle atrophy and contracture. The muscle atrophy and contracture make rearticulation of the prosthetic joint more difficult and increase the risk of luxation after surgery (4). These challenging factors should be addressed and resolved. However, there are lack of reports on techniques and prognosis of THR in patients with chronic coxofemoral joint dislocation secondary to chronic CHD. This case report describes the surgical techniques and outcomes of cementless THR with augmentation of DAR using locking plate and polymethylmethacrylate (PMMA) bone cement and releasing of contractured muscles in 7 dogs with chronic coxofemoral joint dislocation.

Case

Seven dogs were referred to Chungnam National University Veterinary Teaching Hospital for treatment following at least 3 months of hind limb lameness. All patients had a history of initial mild to moderate lameness followed by abrupt deterioration. The patients were diagnosed with at least 2 months of coxofemoral joint dislocation. On physical and orthopedic examination, pain and crepitus were noted in the dislocated hip joint during joint extension and flexion. Excursion angle and thigh girth were decreased compared to the contralateral limb. On radiological examination, the femoral head of the dislocated hip joint was not seated within the acetabulum and luxated in the craniodorsal direction in 7 cases (Fig 1A and 1B).

Prior to the surgery, patients were premedicated with midazolam (0.2 mg/kg IV, Midazolam®; Bukwang, Korea), hydromorphone (0.1 mg/kg IV, Dilid®; Hana, Korea), and cefazolin (22 mg/kg IV, Cefazolin®; Jong-keundang, Korea). Anesthesia was induced with profopol (6 mg/kg IV, Provive®; Myungmoon, Korea) and maintained by inhalation anesthesia with isoflurane (Ifran®; Hana Pharm, Korea). Adjuvant perioperative analgesia was managed with remifentanil HCl (0.1-0.6

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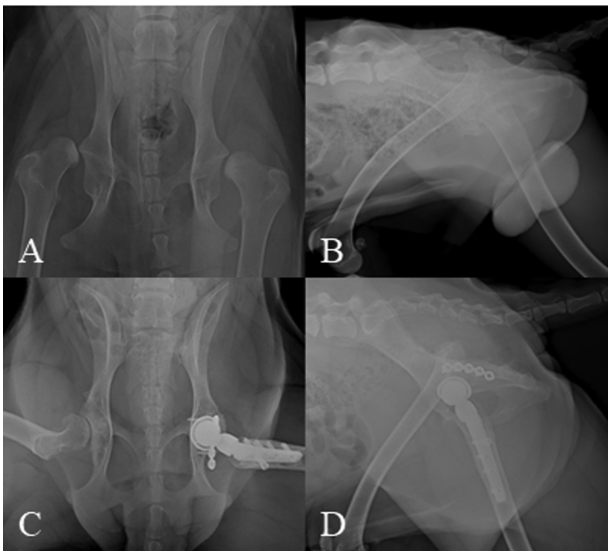

Fig 1. Representative radiographs of the dislocated hip joint. Ventrodorsal (A) and lateral (B). Radiographs showing dislocation and mild degenerative changes of the femoral head acetabulum. Four-month postoperative ventrodorsal (C) and lateral (D) radiographs showing adequate implant positioning without negative changes around the cup or stem.

μg/kg IV CRI, Ultiva®; Glaxo, Korea).

Surgeries were performed with Kyon implants (ZCTHR, Kyon Inc, Zurich, Switzerland) in all cases. All Patients were positioned in lateral recumbency. After the craniodorsal approach, joint capsule was incised. Femur preparation for stem insertion was performed by standard techniques in accordance with the manufacturer's recommendations. The periarticular osteophyte was removed with rongeur and high-speed burr. The acetabular reamer was initially positioned ventrally and then dorsally to excavate under the residual DAR. The reamer was positioned slightly cranial to the original fossa to use the increased bone stock of the caudal ilial segment, and reaming was performed using with version guide. All of the proliferative bony and fibrous tissues surrounding the acetabulum were removed by an acetabular reamer. Then, the reamer size was gradually increased to the patient's acetabular size. To increase bone growth into the cup implant, reaming was performed until bleeding subchondral bone appeared. After the acetabulum was prepared, a cancellous bone graft was harvested from proximal humerus to promote bone ingrowth between the cup implant and the reamed acetabulum. Then, the cup implant was impacted into the prepared acetabulum at a normal angle utilizing the C-arm (BV Pulsera, Philips, Netherlands). A universal locking plate (ULP™, BSCOREM, Korea) was held in place with 2.7-mm cortical screws at the deficiencies of the DAR. The polymethylmethacrylate (PMMA) cement (CMW1; DePuy International, England) was molded with locking plate to reinforce the deficiencies of the dorsal DAR. The stem implant was inserted and bicortical screws and monocortical screws were inserted in the hole of the stem to fix it in the proximal femur to achieve initial stability. After insertion of the prosthetic head on the stem implant, a trial reduction was implemented. However, reduction of the prosthetic joint was challenging. The contractured rectus femoris and pectineus muscle origins were released. Additional skin was incised in the inguinal region in order to approach the pectineus muscle origin. Then, the joint was rearticulated using a reduction hook and Hohmann levers. The tendency of luxation was assessed by manipulating the prosthetic joint and the incision site was closed in layers. Postoperative radiographs revealed appropriate implant positioning and orientation. Controlled activity were carried out for three months. Patients were discharged from the hospital with carprofen (2.2 mg/kg PO, one time daily, Rimadyl®; Pfizer Animal Health, USA) and Cephalexin (15 mg/kg PO, two times daily, Methilexin Inj®, Union Korea Pharm, Korea) for 2 weeks. Radiographs at 4 months after surgery did not show any bone reaction or loosening of the prosthesis (Fig 1C and 1D). The implants were well-positioned, there were no gait abnormalities and complications associated with muscle releasing technique at 12 months followup (Table 1). The function of the affected limb

Table 2. Hip joint excursion angle and thigh girth measurement at 12 months

	Excursion angle (°)		Thigh girth (%)	
	Pre-OP	Post-OP	Pre-OP	Post-OP
Case 1	99	112	86	102
Case 2	89	100	87	106
Case 3	100	115	89	100
Case 4	71	103	71	93
Case 5	88	107	88	98
Case 6	102	113	89	94
Case 7	104	109	86	97

OP, operative.

Table 1. Summary data for 7 dogs that underwent THR surgery with augmentation of DAR and muscle releasing technique

Case	1	2	3	4	5	6	7
Breed	Siberian husky	Labrador retriever	Labrador retriever	Labrador retriever	Chow chow	Jindo dog	Sapsaree dog
Body weight (kg)	24	18	31	38	19	22	20
Preoperative lameness	3/5	4/5	5/5	4/5	3/5	1/5	2/5
Follow-up (months)	56	30	24	14	16	16	18
Outcome at final follow-up	Full function	Full function	Full function	Full function	Acceptable	Full function	Full function
Lameness score at 16 weeks	0/5	0/5	0/5	0/5	1/5	0/5	0/5

had improved (Table 2).

Discussion

THR in dogs with chronic CHD is a challenging problem because of severe morphological changes in hip joint anatomical components. In particular, thoroughly dislocated coxofemoral joint caused by chronic CHD is a potentially more challenging case because of tissue tightness (4). We confirmed deficiency in DAR in 3 cases after acetabular reaming. Though there are simple methods to manage DAR deficiency including implantation of a smaller cup than presurgical templating would suggest, rotating the cup into a more open position, or leaving a portion of the cup exposed laterally beyond the DAR, However, these options may also contribute to luxation or aseptic loosening. One reported THR with their clinical selection criteria for DAR augmentation using locking plate and PMMA cement in 7 dogs with DAR deficiency and shown successful outcomes (3). However, there are no reports on techniques and prognosis of ZCTHR with DAR augmentation (2,7). In our cases, criteria for augmentation of DAR was depend on the raws of cup holes following the full impaction of cup implant. In dogs without DAR deficiencies, fully impacted cups at a normal lateral opening angle of 45° would show several raws of the cup holes consistency in the number of raws in each cups according to size in the manufacturer's recommendations. For example, a 21.5 mm size cup routinely shows one raw, 23.5 mm size cup shows one to two raws, 26.5 mm size cup shows two to three raws and 29.5 mm cup shows three to four raws when fully impacted at a lateral opening angle of 45° (Fig 2A and 2B). The DAR deficiency was augmented if the appeared raws of the cup holes were exceeded its maximum normal range by 2 raws (Fig 2C and 2D). Releasing of the origin of pectineus and rectus femoris muscle was carried out in all cases (Fig 2E and 2F). Contractured these muscles lead to rearticulate the prosthetic joint more difficult during sugery and increase the risk of luxation after surgery. The pectineus muscle releasing procedure relieves the tension on the joint capsule that is caused by the upward force on the coxofemoral joint from a contracted pectineus muscle in hip dysplastic dogs. On this same principle, improved weight loading of the prosthetic femoral head within the acetabulum may result from the increased range of abduction by releasing of a contractured pectineus muscle (4,9). In addition, as the CHD progressed chronically and luxation of the femur head occurred, the rectus femoris muscle became more shortened and contractured. Without muscle origin releasing, a contractured rectus femoris muscle maintains knee in tension with joint flexion. Shortening of the rectus femoris muscle origin and insertion distance also leads to difficulties in prosthetic hip joint rearticulation during surgery and provides upward tension to the limb (5). Other surgical techniques that facilitate reduction include the use of shorter femoral head and neck implants. Tissue tightness caused by muscle contracture may lead to the selection of a relatively short femoral neck (6). Even though an extra-short neck was used in all of our cases, however, it was difficult to rearticulate the prosthetic joint before releasing of contractured muscles. Although we released origin of pectineus and rectus femoris muscle, there were no gait abnormalities and complications associated with this technique and shown increased limb function at 12 months followup. The affected limbs were improving exhibited increased functionality. However, all patients have shown a mildly reduced range of motion of the coxofemoral joint relative to the contralateral limbs or to the coxofemoral joint of normal dogs. However, this reduced angle of joint motion is thought to be clinically insignificant judging by pain free joint manipulation and normal gait. Thus, our clinical outcomes have shown that chronic hip dislocation with DAR deficiency and muscle contracture can be treated successfully by cementless THR with augmentation of the DAR using a locking plate and bone cement and muscle releasing technique. This technique can be considered appropriate when conventional THR is not recommended due to DAR deficiency and muscle contracture.

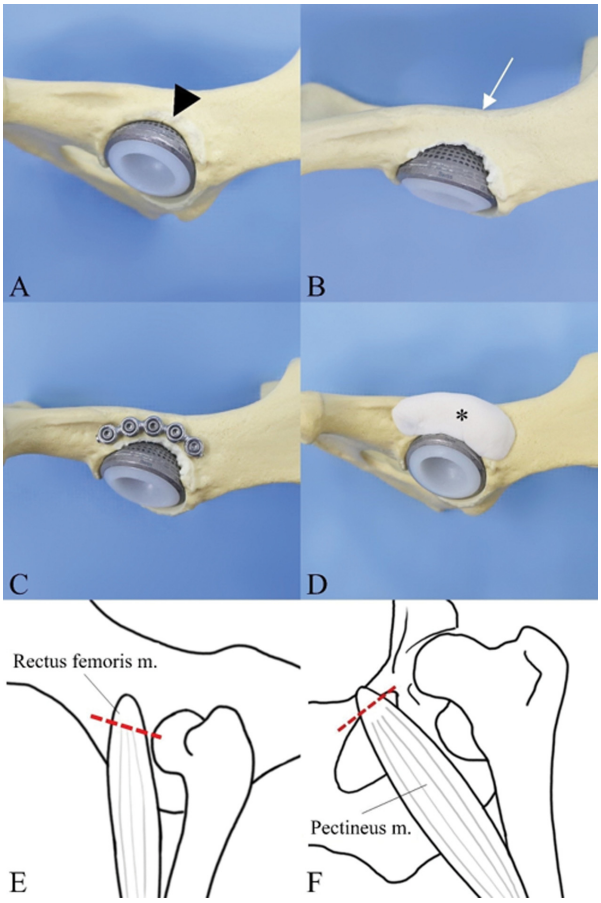

Fig 2. Mimetic surgery images for showing DAR augmentation criteria. Cup positioning at a lateral opening angle of 45° without DAR deficiency showing two raws (arrow head) of the 23.5 mm cup holes (A). Cup positioning at a lateral opening angle of 45° with DAR deficiency (white arrow) showing four raws of the 23.5 mm cup holes (B). Augmentation of the DAR with a 2.7 mm locking plate and PMMA bone cement (asterisk) (C and D). Illustrations of the muscle releasing technique (E and F).

Conclusion

Both dorsal acetabular rim deficiency and muscle contrac-

ture are challenging problem for total hip replacement in dogs with chronic coxofemoral joint dislocation. These are make surgery more difficult and increase the possibility of postoperative complications. Thus, in general, total hip replacement is not indicated for dogs with chronic coxofemoral joint dislocation. Surgical techniques that we described could be considered when conventional total hip replacement is not recommended due to dorsal acetabular rim deficiency and muscle contracture.

Acknowledgements

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References

1. Allen M. Advances in total joint replacement in small animals. J Small Anim Pract 2012; 53: 495-506.
2. DeSandre-Robinson DM, Kim SE, Peck JN, Coggeshall JD, Tremolada G, Pozzi A. Effect of dorsal acetabular rim loss on stability of the zurich cementless total hip acetabular cup in dogs. Vet Surg 2015; 44: 195-199.
3. Fitzpatrick N, Bielecki M, Yeadon R, Hamilton M. Total hip replacement with dorsal acetabular rim augmentation using the SOP™ implant and polymethylmethacrylate cement in seven dogs with dorsal acetabular rim deficiency. Vet Surg 2012; 41: 168-179.
4. Hayes GM, Ramirez J, Langley Hobbs SJ. Does the degree of preoperative subluxation or soft tissue tension affect the incidence of postoperative luxation in dogs after total hip replacement? Vet Surg 2011; 40: 6-13.
5. Heo SY, Seol JW, Lee HB. Total hip replacement in two dogs with unsuccessful femoral head ostectomy. J Vet Sci 2015; 16: 131-134.
6. Hummel D. Zurich cementless total hip replacement. Vet Clin North Am Small Anim Pract 2017; 47: 917-934.
7. Montgomery ML, Kim SE, Dyce J, Pozzi A. The effect of dorsal rim loss on the initial stability of the BioMedtrix cementless acetabular cup. BMC Vet Res 2015; 11: 68.
8. Syrcle J. Hip dysplasia: clinical signs and physical examination findings. Vet Clin North Am Small Anim Pract 2017; 47: 769-775.
9. Wallace LJ. Pectineus Tendon Surgery for the Management of Canine Hip Dysplasia. Vet Clin North Am Small Anim Pract 1992; 22: 607-621.