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Original Article

Anterior titanium plate plus screw of square area combined with posterior column screw for the treatment of fracture of acetabulum involving square area

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Abstract: Objective: To evaluate the effect of anterior special shaping titanium plate with Square District screws combined with posterior column lag screw internal fixation in the treatment of involving the quadrilateral area of acetabular fracture biomechanical stability and clinical effect. Method: The finite element modeling software to establish a double column titanium plate (a), simple anterior special shaping titanium plate and quadrilateral screws (b) and anterior special shaping titanium plate with Square District screws combined with posterior column lag screw (c) internal fixation in the treatment of involving the quadrilateral area of acetabular fracture model. Three dimensional finite element analysis of the 5 kinds of standard gait. Secondly, 21 cases of acetabular fractures involving the square region from March 2010 to May 2013 were retrospectively analyzed, including 13 males and 8 females, aged from 19 to 65 years, with an average age of 41.2 years. The use of single iliac groin approach, the use of titanium plate combined with square area screw fixation for the treatment of internal fixation. Results: Three in all kinds of gait, 1 kinds of internal fixation and normal model were compared, and the average displacement of each node in the fracture line was C < B < normal model < A. The statistical analysis showed that in 22 degrees of hip flexion and extension degrees 12 and 14 degrees, the differences between no significant ($P > 0.05$) and in 18 degrees of hip flexion and extension of 4 degrees, the differences between fixed A and B, A and C only with statistical significant difference ($P < 0.05$). 21 patients were followed up for an average of 21.4 months (7 to 38 months). According to Matta criteria, the quality of acetabular fracture reduction was evaluated: anatomic reduction of 14 cases, satisfactory reduction in 6 cases, and unsatisfactory reduction in 1 case. The function of hip joint was evaluated by D Aubign's-Postel function score: 12 cases were excellent, 5 cases were good, 3 cases were poor, 1 case was poor, the excellent and good rate was 81%. Complications: 2 cases of lateral femoral cutaneous nerve palsy, 1 cases of heterotopic ossification, 2 cases of traumatic arthritis, the incidence rate was 23.8%. Conclusion: Anterior special shaping titanium plate with Square District screws combined with posterior column lag screw internal fixation in the treatment of involving the quadrilateral area of acetabular fractures with good biomechanical stability. It has the advantages of less trauma, reliable fixation, low incidence of complications, and satisfactory clinical effect. It is a feasible method to deal with this kind of acetabular fractures.

Keywords: Acetabular fractures, finite element analysis, internal fixation, standard gait

Introduction

Acetabular fractures are more common in young adults with high energy injury, conservative treatment of general adaptation to shift is not obvious, the obviously displaced persons (> 3 mm), the non operative treatment is ineffective, especially square associated with fracture, conservative treatment of traumatic arthritis and other serious complications may be left behind, resulting in dysfunction of the hip. For this kind of fracture, the current emphasis on the treatment of the fracture of the acetabulum with anatomical reduction and firm internal fixation maximized the recovery of joint function [1, 2]. But due to the irregular morphology of hip,

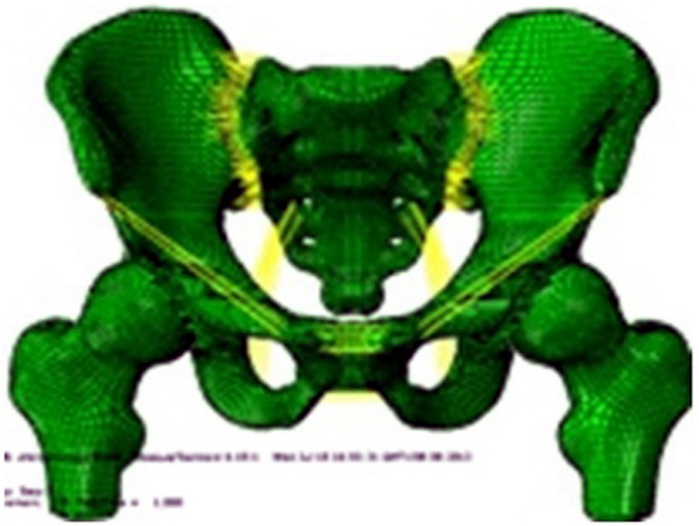

Figure 1. Normal pelvis model.

Table 1. Morphological verification results (mm) P=0.786

	1	2	3	4	5	6	7	8	9
RM (d_1)	156.4	100.2	202.5	95.4	60.7	55.1	123.2	110.0	24.8
FEM (d_2)	157.6	99.8	202.2	96.9	60.4	54.2	122.5	110.1	25.3

RM: 3D reconstruction model, FEM, finite element model, D1, the distance of each measuring point on the 3D reconstruction model, D2: the distance of the measuring points on the finite element model. 1. Anterior on the spine to the iliac spine. 2. The anterior superior iliac spine to the greater sciatic notch and the highest point, 3. Iliac crest the highest point to the ischial tuberosity. 4. The ischial tuberosity to ipsilateral to the pubic tubercle, 5. Acetabular fossa of maximum longitudinal axis, 6. Acetabular fossa of maximum horizontal axis, 7 sacral promontory to the anterior superior iliac spine, the margin of 8. Bilateral sacroiliac joints, before and after 9. S1 middle vertebral margin.

fracture types of diversity and the location of the acetabulum deeper, surgical treatment has been problems in the field of orthopaedics. And with the fracture fixation theory to the transformation of biological fixation model (Bo), we emphasize the anatomical reduction of the articular surface at the same time, but also stressed that the protection of soft tissue and minimize surgical trauma and postoperative complications occur [2]. In recent years, we use after anterior special shaping titanium plate with Square District screws combined with column lag screws for the treatment of involving the square area of complex acetabular fracture, the effective reduction and fixation at the same time, reduce the surgical trauma, shorten the operation time, and reduce the occurrence of complications. In this study, a three-dimensional finite element method was used to investigate the biomechanical properties and provide the necessary basis for the clinical application. And a retrospective analysis of our hospital in March 2010 to 2013 years 5 months were a total of 21 cases were treated with anterior special shaping titanium plate with Square District screws combined with column lag screw internal fixed involving square area of acetabular fractures and to analyze the clinical efficacy.

Materials and methods

Establishment of the complete pelvis model

A total of 473 CT images were obtained from the CT scan of the pelvis of the volunteers. Import CT images into medical modeling software Mimics 10.1. 3D reconstruction. Then import the Ansys12.0-ICEM into the grid (6 nodes, 8 mesh). And then import the V10.0 Hypermesh to modify the mesh, adjust the quality of the grid. And select the corresponding nodes in the model surface reconstruction. Finally, the model of the material properties of the assignment [3, 4] builds the pelvis model, the unit number 112002, the node number 115940. Model included sacrum and ilium and femur 1/3, sacral endplate and cartilage, bone and cartilage endplate cartilage, the acetabulum and the femoral head cartilage surface, pubic disc. Cortical bone thickness was defined as 1.5 mm [5], built ligaments included: sacroiliac ligament, sacrospinous ligament, sacrotuberous ligament, iliolumbar ligament, the inguinal ligament, superior pubic ligament, arcuate pubic ligament (**Figure 1**).

Validation of the validity of the 1.2 models

State verification: 1. Anterior on the spine to the iliac spine. 2. The anterior superior iliac spine to the greater sciatic notch and the highest point, 3. Iliac crest the highest point to the ischial tuberosity. 4. The ischial tuberosity to ipsilateral to the pubic tubercle, 5. Acetabular fossa of maximum longitudinal axis, 6. Acetabular fossa of maximum horizontal axis, 7 sacral promontory to the anterior superior iliac

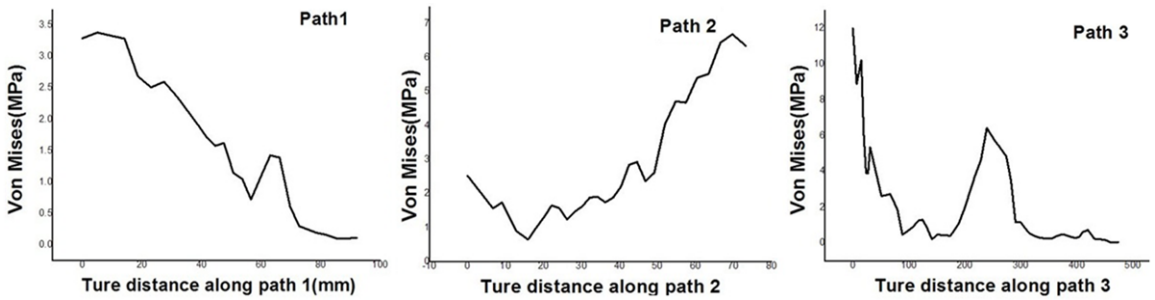

Figure 2. The stress distribution of the nodes on the path 1, 2 and 3.

spine, the margin of 8. Bilateral sacroiliac joints, before and after 9. S1 middle vertebral margin. In the finite element model and 3D reconstruction, the difference between the two is analyzed by t test. The results show that the two are highly consistent (P=0.786) (**Table 1**).

Verification of mechanical characteristics: the model is imported into Abaqus 6.10 software. Simulated feet stand. The rigid surface was set up in the S1 vertebral body, and the uniform distribution of the load was given, and the gravity direction was simulated, and the size was 600 N. Boundary conditions: to restrict the proximal femur, to restrict the freedom of the 6 directions. Starting from the arcuate line, pubic branch to pubic symphysis was path 1; along the margin of acetabulum anterior, superior and posterior was path 2; right sacral promontory along the right ilium and right sciatic, right pubic branch to pubic symphysis was path 3. The stress path curves (**Figure 2**) of the 3 paths are respectively made. From the 3 paths can be seen, along the path of the 1 stress point in the arcuate line at large. After the stress decreases gradually, to the pubic ramus force increased slightly. Along the path of the stress distribution in the promontory of the sacrum, sacroiliac joints, and the dome of acetabulum medial cortical bone should force is larger, and along the posterior column of the acetabulum stress gradually decreased, but to the ischial tuberosity stress slightly concentrated. This result is in accord with the theoretical and relevant research results [6] proved that the model is effective.

Internal fixation and muscle model

Effective model of the pelvis of the right model, in accordance with the muscle proximal and distal ends of the physiological attachment point with truss element in the model simulating the surface across the hip joint of the 22 muscles (**Figure 3A**). The model of acetabular fractures (**Figure 3B**) was established by the weakening of the grid in the [7]. Three internal fixation models (**Figures 3C-E**, **4**), A, B, and C are established. Between the three and the bone of the titanium plate, the screw and the bone are used to embed and coupling. Titanium plate are simulated A0 titanium plate reconstruction (ordinary synthes company), column lag screw simulation Ao 3.5-mm screws (common type synthes company), the remaining screws simulation Ao 3.5-mm cortical screws (common type synthes company). Materials are simulated with titanium alloy, the elastic modulus is 110GPa, and the Poisson's ratio is 0.3. [8] post column lag screw in the screw entry point and direction can be referred to the relevant literature [9]. Try to ensure that the screw and the column of the main fracture line angle in the range of 60~90. Other internal fixation methods refer to the relevant literature [10, 11].

Constraints on the model loading and hypothesis

Build the right pelvic model was imported into Abaqus 6.10 software. Fixed right sacrum endplate simulated sacral support and of pubic joint constraints, to load distribution from the model of distal femur rigid surface loading. Muscle contraction force is loaded on the muscle in accordance with the literature [12]. The gait are set 15 degrees of adduction of the femoral head, in the before and after a pelvic and femoral head, hip flexion and extension) point of view is to change (**Table 2**). Hypothesis: the biological materials involved in this experiment are assumed to be homogeneous, continuous and isotropic. By force, the models of

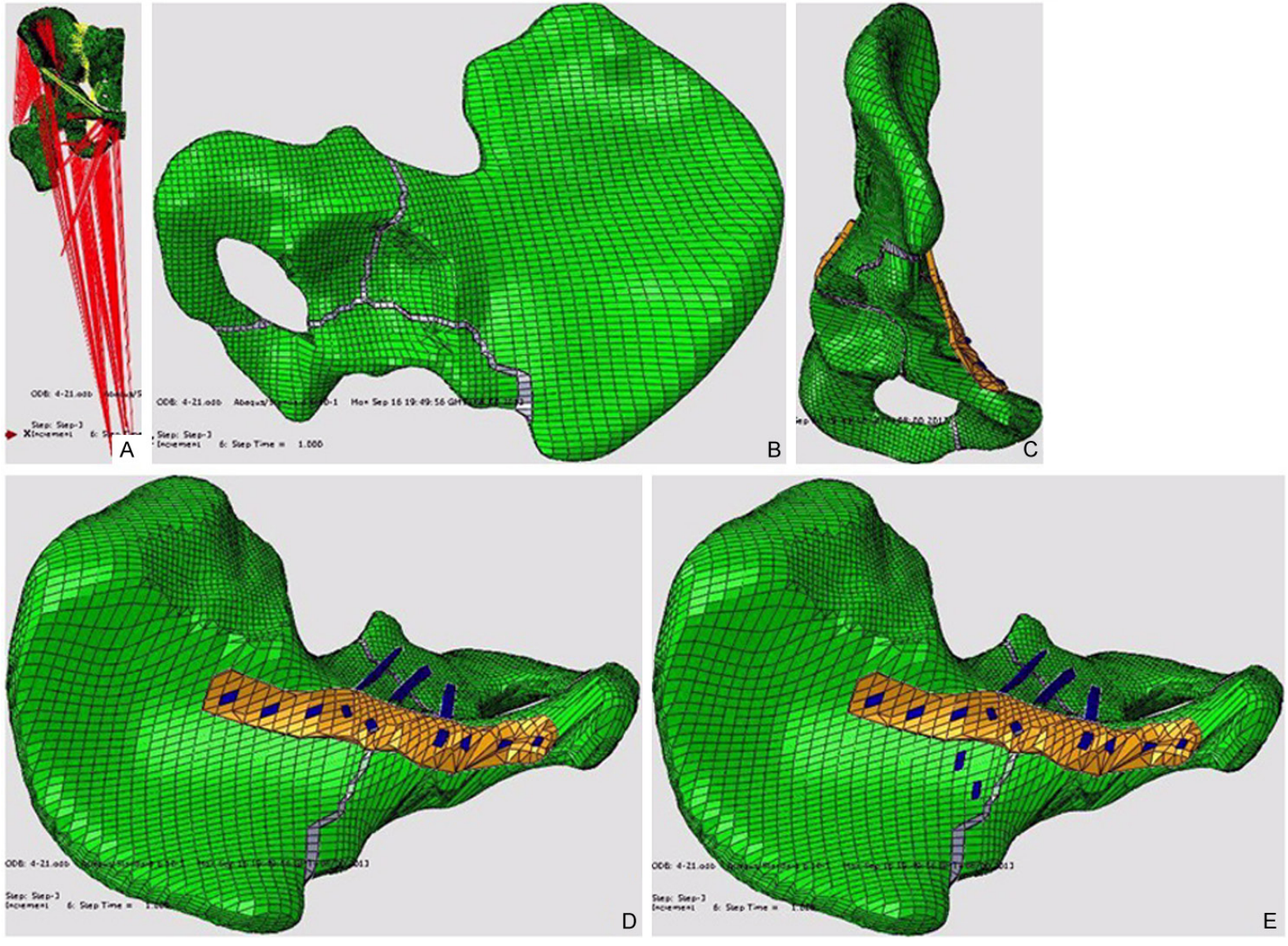

Figure 3. Right pelvic muscle model (A), the model of acetabular fractures involving the quadrilateral area (B), (A-C) internal fixation model (C-E).

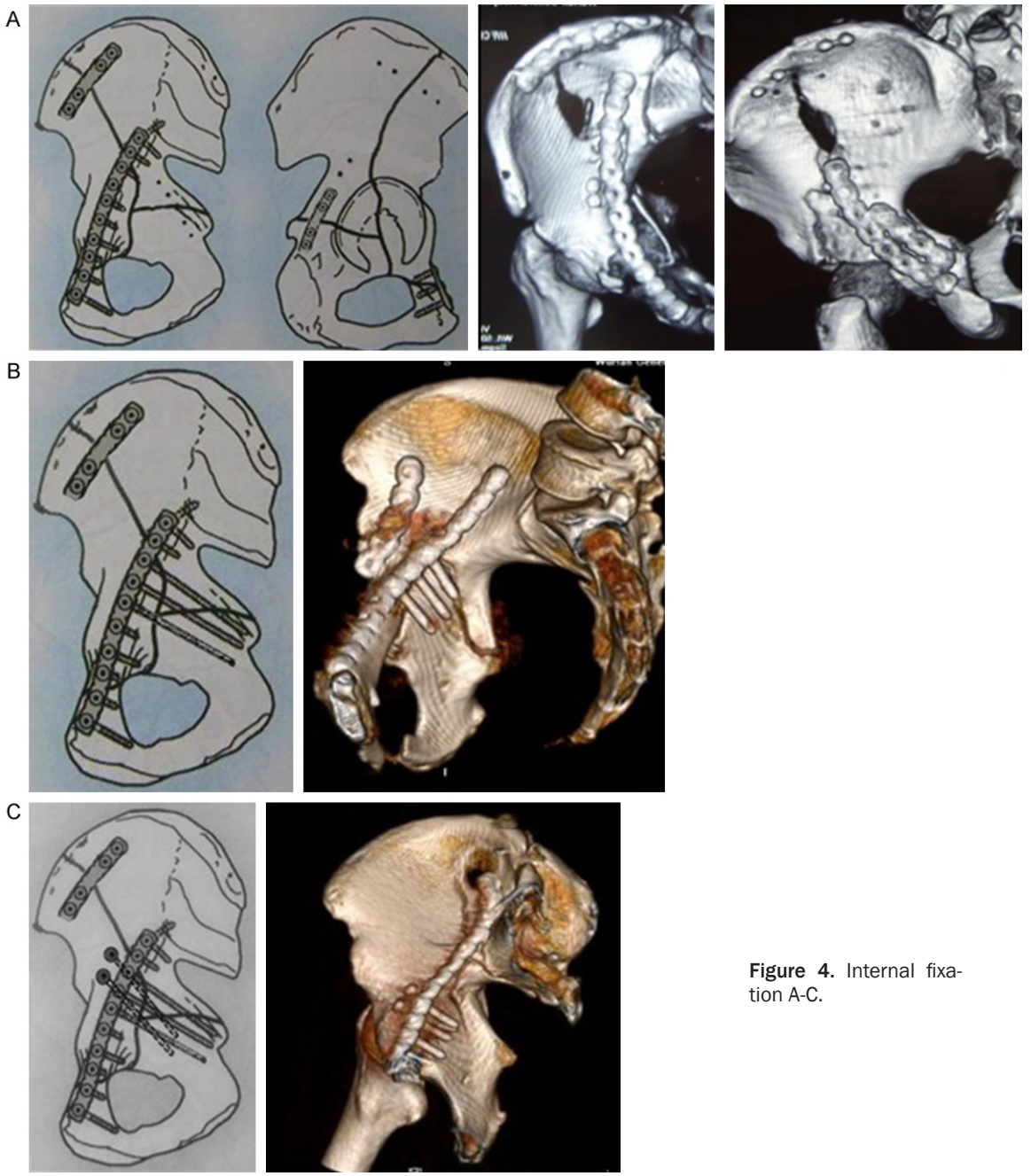

Figure 4. Internal fixation A-C.

each section are not produced from each other, and each unit has enough stability, and the deformation of the material is small.

Clinical cases

In this group, 21 cases, male 13 cases, female 8 cases, aged 65 to 19 years old, average 41.2 years old. The causes of injury: 15 cases of traffic injury, 3 cases of bruise, falling injury in 3 cases. There were 11 cases of double column fractures, 5 cases of T fractures, 5 cases of anterior column with the second half according to Letournel classification method. Injury to the operation time of 4~16 D, an average of 6.5 D. Combined injury: 4 cases of limb fractures, 1 cases of lumbar vertebral compression fractures, 2 cases of closed abdominal injury, 1 cases of closed chest injury, 1 cases of traumatic brain injury. Injury with heavier were in emergency EICU or related college department treatment to be in stable condition after transferred to our department, injury to into the average time was 3.2 days (1~12 d), 1 cases of patients with traumatic brain injury in the Department of neurosurgery in our hospital

Table 2. Load force parameters of support phase in gait cycle

	Gait cycle	The size of joint force (N)			The direction of joint force
		x	y	z	
1	Double support, beginning right stance phase	-234.0	558.0	516.0	Anteflexion 22°
2	Beginning right single support phase	-558.0	755.0	1229.0	Anteflexion 18°
3	Halfway right single support phase	-522.0	594.0	1077.0	Posteroextension 4°
4	End right single support phase	-627.0	594.0	1682.0	Posteroextension 12°
5	Double support, end right stance phase	-594.0	679.0	1612.0	Posteroextension 14°

hospital 12 days later transferred to our department.

Clinical treatment

Preoperative preparation: after admission, all patients were treated with limb skeletal traction, part associated with severe hip joint dislocation, traction weight up to 12~15 kg, traction after 3 days of X-ray, reset traction weight changed to 6~10 kg. All patients underwent pelvic anteroposterior, obturator oblique, iliac oblique position X-ray film and CT scan and 3D reconstruction. At the same time during the treatment of associated injury. Preoperative were first in the pelvis model simulation approximate acetabular fracture line, determine the operative reduction method and sequence, and implant placement, especially after column lag screw insertion point and the direction, the preoperative preparation of autologous blood transfusion machine and preparation of blood 400~800 ml. Antibiotics, 0.5 to 2 h before surgery, to prevent infection. 2 operation methods: the patients were under general anesthesia in the operation, the affected side in the lateral position of "floating" sterilized. Routine disinfection of wild and sterile drapes, will be placed on a patient close to the supine position, according to letournel describes the ilioinguinal approach exposure from the sacroiliac joint to the symphysis of the hip pelvic surface structure, including complete pre column and the quadrilateral surface and column inner surface. Reduction of the fracture of the anterior column under direct vision, and the reduction of the posterior column and the square region of the Matta clamp. The anterior column fixation with reconstruction titanium plate placed in the arcuate line of acetabular margin, are fixed on both ends of the ilium and pubis. After column with 1 to 2 pieces column lag screw from the pelvis ring screw in the front columns are mainly fracture block are fixed, and then square screw the acetabular iliopubic uplift above titanium plate screw holes for multiple elastic fixed [10, 11]. The 3DX line machine perspective to determine good fracture reduction, stable fixation, screws did not enter the joint cavity, in the iliac fossa to the pubic region of the deep and shallow were placed tube drainage, closing the wound. 3. After the operation were given to maintain the weight of skin traction for 14 days, routine use of antibiotics for 48 h 36 to 72 h after pulled out drainage pipe, review the pelvis, obturator oblique, iliac oblique X-ray films, and CT scan and 3D reconstruction, encourage patients to do isometric contractions of the muscles of the lower limb, allow foot ankle active, after 14 days of hip flexion exercise. Depending on the fixation and fracture, as well as X-ray performance decided to get out of bed time, the general 10~12 weeks after gradually load.

Evaluation index

Acetabular medial wall after acetabular posterior to the acetabulum rim fracture line each node consists of a fracture line path (normal model from the same node) for measuring fracture line size on the displacement of each node. The displacement of each node in the fracture line is compared. The larger the displacement, the more unstable.

The operative time, intraoperative blood loss, the modified Matta acetabular fracture reduction criteria [13] to evaluate fracture reduction quality and modified Merle D A'ubigne-Postel hip score function evaluation [14] and postoperative complications incidence.

Statistical processing

Using SPSS 19.0 software for statistical analysis, the finite element model and the three-dimensional reconstruction model of morphology compared with t test; various gait, the displacement difference of different models

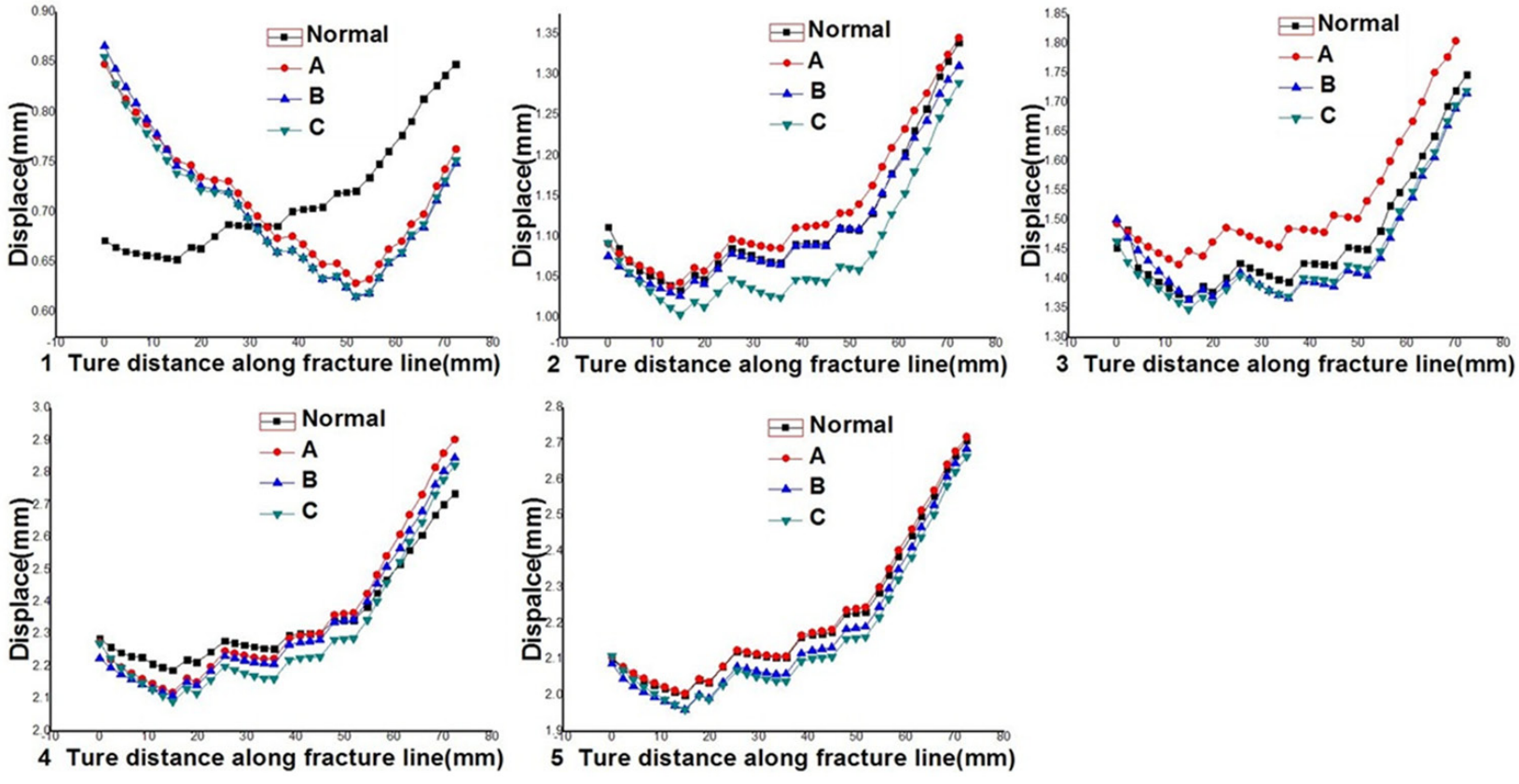

Figure 5. Displacement distribution of nodes on the A, B and C three internal fixation model and normal model (Normal) in the gait.

Table 3. The comparison and analysis of variance of C, B and A 35 kinds of internal fixation model and normal model (Normal) fracture line

	A (mm)	B (mm)	C (mm)	Normal	*F*	P
1	0.715±0.060	0.707±0.068	0.704±0.063	0.713±0.057	0.218	0.884
*2	1.151±0.093	1.104±0.083	1.080±0.077	1.119±0.083	4.029	0.008
*3	1.514±0.127	1.450±0.097	1.446±0.102	1.470±0.105	2.719	0.047
4	2.354±0.224	2.328±0.211	2.299±0.205	2.346±0.154	0.483	0.695
5	2.221±0.207	2.176±0.208	2.163±0.199	2.213±0.203	0.625	0.600

*Internal fixation with B and A, C and A were significantly different, and there was no significant difference between C and B. 1: Anteflexion 22°; 2: Anteflexion 18°; 3: Posteroextension 4°; 4: Posteroextension 12°; 5: Posteroextension 14°.

with single factor variance analysis to test, if significant differences when using LSD-t (least significant difference-t), pairwise multiple comparison, $P < 0.05$ was considered as statistically significant.

Results

It can be seen From **Figure 5** and **Table 3** in various models of fracture healing, for fracture line size on the average node displacement showed C < B < normal model < A. Through variance analysis, gait 1, 4, 5 22 degrees of hip flexion, extension of 12 degrees and extension is 14 degrees, the difference was not statistically significant ($P > 0.05$) was found. In gait 2, 18 degrees 3 and flexion and extension 4 degree difference was statistically significant ($P < 0.05$); further by pairwise comparison found that the difference between fixed a and B, C only with statistical significance ($P < 0.05$), and the difference between B and C and normal model no statistically significant ($P > 0.05$).

The operation time was 120 to 270 min, the average was 190 min, the blood loss was 300 to 1800 mL, the average was 540 mL. According to the modified Matta acetabular fracture reduction standard [13] assessment of the quality of fracture reduction: anatomical reduction (shift 1 mm), 14 cases of poor reduction (shift more than 1 mm), 6 cases, reduction is not satisfied (shift more than 3 mm) 1 case. No screw penetrating the acetabulum found. 21 patients were followed up for 7 to 38 months (average, 21.4 months). Observation of patients with hip joint pain, activity and walking, according to the modified Merle D A'ubigne-Postel hip score were used to assess the function of [14]: excellent in 12 cases, good in 5 cases, 3 cases and poor in 1 cases, the excellent and good rate was 89.1%. The patients had no complications of sciatic nerve, femoral nerve injury and incision infection. Femoral lateral cutaneous nerve palsy occurred in 2 cases, 1 cases occurred in 4 months after surgery, 2 cases of heterotopic ossification, cases of traumatic arthritis, the incidence of complications was 23.8%. No internal fixation failure. 2 cases of lateral femoral cutaneous nerve palsy in patients with no special treatment, were recovered before discharge. 1 case of heterotopic ossification in patients was with no obvious symptoms, no special treatment. 2 cases of traumatic arthritis patients were manifested as pain, X-ray film is a joint surface sclerosis, joint space stenosis. Ask the patient to rest as much as possible, to allow patients to take care of themselves in daily life, physical therapy and oral anti-inflammatory analgesic drugs given. Symptoms were relieved.

Discussion

This study not only verifies the anterior special shaping titanium plate with Square District screws combined with column lag screw fixed biomechanical stability, and a simple analysis of the clinical effect, involving the square area of complex acetabular fracture treatment provides a is not only more stable, and more minimally invasive and safe approach for internal fixation. But for the operative treatment of acetabular fractures after, in fact, is not advocated immediate weight-bearing walking. Acetabulum square area also known as square, located in the posterior column of the acetabulum in side, adjacent to the medial wall of the acetabulum, thin structure, slightly careless, screw easily into the joint, effect of internal fixation. Traditional fixed square area fracture after reduction of the fracture, with reconstruction titanium plate fixation in the anterior column, in the acetabular parallel to the edge of the square area with reconstruction titanium plate with 3 pieces of long screw internal fixation, but the fixed need away from the acetabulum the thinnest, around the hip, is not slightly careful screw into the joint, resulting in fixation failure [15, 16]. Lin et al. [17] proposed the temporary reduction and fixation of bone block in the square block with the combination of steel plate and steel wire. The defect is wire Square

District, partial most of the fracture fragments of bone without obvious pressurizing effect, simply by sheet elastic compression, pressure single area, weak interaction, wire around the greater sciatic notch, stripping operation, on the sciatic nerve and blood vessel injury probability high. Culemann et al. H is used to fix the fracture of the [16] shaped plate. The advantage is that it has a good fixation effect on the fracture of the square area, and can avoid the screw into the joint cavity. But it is unable to provide effective fixation for the comminuted acetabular square area. Culemann [16], with 1 block with multidirectional locking screw titanium plate of the square area are fixed, and with H shaped elastic steel plate fixation: a biomechanical comparison that the stability is better. And because the screw is easy to design, allowing the screws to adjust within 15 DEG, which can effectively avoid the screw into the joint cavity.

Involved in the square region characteristic of fracture and fixation principle, in our hospital from 2005 began fractures with anterior titanium plate and quadrilateral screws fixed square area, clinical operation is simple, safe and fixed effect is reliable [10, 11]. But in practice we found that after the reduction of the posterior column, such as not to make simple fixed, is not conducive to the square screw implantation, and even lead to reduction of loss, repeatedly resets the operation time to extend and increase the surgical trauma. In order to compensate for this shortcoming, satisfactory fracture reduction, to 1 to 2 screws by pelvic pelvic surface near the margin of the true pelvis screw and direction from external oblique inward, let the screw from the medial square cortex exposed within the pelvis, to from posterior column fracture line at least 1 cm. According to the post column fracture line type, they can be adjusted to the screw position and angle, as far as possible to make screws and posterior column fracture line to maintain 60 degrees ~90. This can be simply fixed after column, and can be operated under the open, the possibility of the screw into the joint, easy to operate and control. The plastic of AO reconstruction titanium plate placed in the arcuate line edge, first with 2~3 pieces of cancellous bone screw of the pubis end is fixed, then through the hole of the upper edge of the square area reconstruction titanium plates and screws with an electric drill slotted, possible for the direction of the vertical plate, parallel square area, after tapping screw in 2~5 semi cortical bone screw, screw length in excess of the fracture line 10 mm is appropriate. Finally, 2~3 cancellous bone screws were used to fix the titanium plate. On the basis of the internal fixation of the anterior titanium plate and the square region, the advantages are: (1) can be reset and fixed to a certain extent. (2) after the column is stable and easy to be easy to square area screw placement. (3) screw from the top of the pelvic brim as close as possible to the true pelvis edge nail, direction from external oblique inward, let the screw from the medial square cortex exposed within the pelvis, to from posterior column fracture line at least 10 mm, can under direct vision operation, effectively avoid the screw into the joint cavity. (4) the use of post column lag screws, to a certain extent, also strengthen the effect of the post column internal fixation. (5) for square area and column separation, we use quadrilateral screws fixed square area, column lag screw can use long screw from pelvic pelvic surface is screwed into the ischial spine or sciatic nodules fixed posterior column, thereby increasing the surgical indications.

At present, the biomechanical study using three-dimensional finite element method is an effective means, but because of the pelvis of the irregular geometry, complex anatomical structures, resulting in previous models only for partial pelvic area, such as single of the ilium and sacrum of modeling [18]. A small number of studies, including the main pelvic area [18], but also used the over simplified design, can not fully reflect the true anatomy of the pelvis and mechanical properties. To this end, the research group established a three-dimensional finite element model of the whole pelvis. And the finite element model and the original pelvis maintain a high degree of geometric similarity. Due to the sacroiliac joint anatomical structure is very complex, also in pelvic biomechanical analysis in the most important position, so in the modeling design of the rebuilt actual sacroiliac joint of various anatomical structures, including the actual thickness of sacroiliac endplate cartilage [19]. In addition, the key part of this experiment is to improve the accuracy of numerical simulation in order to improve the accuracy of numerical simulation. And the model also includes 1/3, femoral head and acetabulum cartilage. In the model, the accurate anatomical position of the large range of

the ligament group and the muscle group across the hip joint was reconstructed. Then the finite element model and the three-dimensional reconstruction model are compared, and the model is ensured. And the simulation of standing position, under normal physiological load, biomechanical properties of a complete study of the pelvis, the cognition theory and related research results were compared strictly verify the validity of the model.

The anterior special shaping titanium plate with Square District screws combined with posterior column screw internal fixation, double column and anterior titanium plate special shaping titanium plate with square area screw internal fixation with normal model is found three kinds of internal fixation methods of total square area of complex acetabular fracture has good fixation effect. Internal fixation with titanium plate displacement of three kinds of internal fixation methods, although only in flexion 18 degrees and extension 4 degrees, double column titanium plate and other two kinds of internal fixation methods of the difference is statistically significant, while in other gait, three kinds of internal fixation methods showed no significant statistical significance, but the three kinds of internal fixing position of the moving average ratio, anterior special shaped titanium plate and Square District screws combined with posterior column screw number in a variety of gait was the smallest, which in a certain sense still has reference significance, indicating that the anterior special shaped titanium plate with Square District screws combined with posterior column screw internal fixation is double column treatment involving the square area of complex acetabular fracture is more reliable. At the same time we can not deny has a simple anterior special shaped titanium plate with square area screw better effect, and the internal fixation with a double column and titanium plate internal fixation smaller trauma, than simple anterior special shaping titanium plate plus quadrilateral screw more convenient reduction skills and wider indications.

Retrospective analysis of clinical on 21 cases, posterior column fracture lines were close to letournel classification standard for describing the type of fracture line, were treated with anterior titanium plate with Square District screws combined with posterior column screw internal fixation, anatomical reduction rate reached 76.2%. Postoperative follow-up function was excellent and good rate reached 89.1%. The clinical effect was satisfactory. This group of patients with poor reduction of 1 cases, the main reason may be more than 2 weeks after the injury surgery. The poor reduction may and fracture end of fibrous callus to clear about, so for more than 2 weeks of complex acetabular fractures and were found in reduction of the posterior column poor is encouraged by combined anterior and posterior approach in the treatment.

The fixed adaptation on the joint surface without obvious collapse, after the pole shift to smaller and crushing of fresh complex acetabular fractures, including part of the double column fracture, T shaped fracture, anterior column and posterior hemitransverse fracture. This method is not suitable for the post column crushing, even after the screw can not be fixed. The posterior column displacement is too large or the acetabular bearing area has obvious collapse, the single iliac groin approach can not be satisfied with the reduction, nor suitable for using this method. In addition to the old fractures, a single iliac groin approach can not be satisfied with the reduction, we also recommend the use of combined approach before and after the expansion of the road.

In 21 cases, 5 cases were found early and late complications, the incidence of complications was 23.8%. 2 cases of lateral femoral cutaneous nerve paralysis, not special treatment, in order to recover before discharge. 2 cases of traumatic arthritis were treated with conservative treatment, the symptoms were relieved. Using the ilioinguinal approach for surgical treatment, there was a low rate of complications although compared with the combined anterior and posterior approach, but complications occur should still attracted our attention, how to avoid or reduce the occurrence of complications, is worthy of our attention: heterotopic ossification following surgical treatment of acetabular fractures: 1 cases of heterotopic ossification in this group, the patients after column fracture line over the greater sciatic notch, in the anterior column and square area reduction, posterior column in the greater sciatic notch still apparent shift, in the reduction process, appropriate stripping the outer table of the ilium gluteus muscle insertions, heterotopic ossification consider with this. Prevention approach is to choose the surgical approach of the groin as far as possible, because this

approach does not interfere with the hip joint abduction, the incidence of heterotopic ossification after surgery is low [20]. Mourad [21] research found that after injury early oral administration of indomethacin or (and) localized small doses of radiation therapy can significantly reduce the incidence of heterotopic ossification. In addition, the closure of the incision was thoroughly washed, and effective drainage and other measures can reduce the occurrence of heterotopic ossification. Due to the reduction of the reduction, the stress distribution of the acetabulum is abnormal. Operation as far as possible anatomical reduction, rigid fixation can effectively reduce the incidence of traumatic arthritis, the single ilioinguinal approach for surgical treatment, as revealed after column or reduction of the articular surface not satisfied, increased immediately after the approach, combined anterior posterior approach road linkage reduction, fracture fixation, and improve the quality of fracture reduction is to avoid the occurrence of traumatic arthritis is an important method of postoperative. The lateral femoral cutaneous nerve injury should also pay attention to, the nerves in the anterior superior iliac spine front shape, but different variation larger, in the process of operation is easy to damage. Preventive measures in the operation process, the surgeon should be familiar with the anatomy of the lateral femoral cutaneous nerve, to understand the conventional variation, but also to be patient, carefully looking for, it should also avoid blind lead.

In summary, the titanium plate and the square region of the posterior column lag screw in the treatment of complex acetabular fractures with minimally invasive, feasible and better clinical effect of internal fixation. But when using the internal fixation for surgical treatment of acetabular and operation must be of pelvic anatomy with better understanding. You must also master anterior titanium plate and a quadrilateral screws multi point elastic fixation mechanism, in order to ensure good clinical effect.

The research in gait analysis, although more focused of force analysis of the acetabular region, but there are no negative fact too. At the same time, the model itself has some simple processing, the analysis result and the real situation have some difference. The clinical analysis was retrospective analysis, the follow-up sample was small, some patients were followed up for a long time, the results may have a certain impact on the results. Lack of comparative study is also our shortcomings. We will further improve the deficiencies in the next work.

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Disclosure conflict of interest

None.

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