



International Journal of Orthopaedics Sciences

ISSN: 2395-1958
IJOS 2019; 5(2): 646-652
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www.orthopaper.com
Received: 18-02-2019
Accepted: 22-03-2019

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A prospective study of functional outcome of distal fibula fractures with syndesmotom injury managed by anatomical locking compression plate and syndesmotom suture button fixation

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DOI: <https://doi.org/10.22271/ortho.2019.v5.i2i.66>

Abstract

Syndesmotom injury can occur after trauma to the ankle, both with and without a fracture. In fractures of the ankle, syndesmotom injury occurs in about 50% of type Weber B and in all type Weber C fractures. Syndesmotom diastasis left unnoticed can lead to persisting pain, instability and progressive arthritis. This study focusses on the application of syndesmotom suture button anchor as a fixation method for the syndesmotom joint diastasis. The syndesmotom button fixation does not convert the joint into a rigid articulation and still allows micro motion to happen. In this study, Distal fibular fractures with syndesmotom injuries are selected and anatomically precontoured locking compression plate is applied for fracture fixation and syndesmotom suture button fixation is done for the syndesmotom injury and their functional outcomes studied by various modalities.

Keywords: Syndesmotom injury, Ankle, suture button

Introduction

Ankle joint is a complex weight bearing joint. It enables lots of thrust forces to pass through the joint on weight bearing.

Syndesmotom injury can occur after trauma to the ankle, both with and without a fracture. Conventional treatment modality for fixation of the syndesmotom injury when diagnosed is with the help of screw fixation, one or two screws depending upon the fracture pattern and the instability. Screw fixation has been associated with many shortcomings as it converts the distal tibiofibular joint into a rigid joint and has got screw related complications like breakage, infection and difficulty at the time of removal.

This study focusses on the application of syndesmotom suture button anchor as a fixation method for the syndesmotom joint diastasis. The syndesmotom button fixation does not convert the joint into a rigid articulation and still allows micro motion to happen.

Aim of the study

To study the functional outcome of distal fibula fractures with syndesmotom injury managed by distal fibula anatomical locking compression plate and syndesmotom suture button fixation.

Materials and methods

This study was formally approved by the Ethical committee of Kilpauk Medical College and Hospital and was carried out under their guidance.

This prospective study was carried out at Department of Orthopaedics, Govt. Kilpauk Medical College and hospital, Chennai between September 2014- July 2018.

Inclusion criteria

A total sample size of 20 patients were included in this study who satisfied the following criterias.

1. Age above 18 years.

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2. Skeletally matured.
3. Distal fibula fractures with Weber B and Weber C type of Danis – Weber classification.
4. X-ray suggestive of associated syndesmotom injury.

MRI of the ankle was done wherever possible to diagnose syndesmotom ligament injury and intraoperative stress testing was done to confirm.

All the included patients were duly explained about the procedure and all the treatment options were explained.

Exclusion criteria

1. Weber A type Fractures
2. Distal fibula fracture without syndesmotom injury.
3. Pediatric and skeletally immature patients
4. Compound injuries
5. Associated neurovascular injuries
6. Pathological fractures
7. Old fractures

All the admitted patients were thoroughly evaluated by doing clinical examination and other injuries were rule out, the distal fibula fracture was initially immobilized by applying a short leg slab and was processed for surgery after preoperative evaluation and planning

With proper consent, patients involved in this study were posted for surgery with distal fibula locking compression plate and syndesmotom suture button fixation.

Post operatively, all the patients were advised to keep the limb elevated, intravenous antibiotic cover was provided till 5th day and then it was converted to oral antibiotics. Post-operative x-ray was taken on the next day after surgery.

Check dressing was done on the 2nd and 5th day. Patients were discharged after 5th post-operative day and sutures were removed on the 12th post-operative day.

Strict non- weight bearing was advised for the patients. Assisted ankle mobilization was initiated. Check x-ray was taken at 6 weeks.

Partial weight bearing was advised with support by 8 weeks. After confirming consolidation and radiological signs of union, full weight bearing was initiated from 12th week onwards.

Functional outcome was done using the American Orthopaedic Foot and Ankle Society (AOFAS) – Ankle and hind foot scale scoring system.

Radiological outcome was observed based on the appearance of bridging callus and fracture line consolidation in successive follow up x-rays.

Clinical outcome was observed based on the absence of tenderness. Secondary outcomes were measured based on the perioperative data like duration of the surgery, amount of blood loss, length of the incision and complications like neurovascular injury, non-union, malunion, implant failure, infection.

Case reports

Case 1



Immediate post op x-ray



Mortise View

Lateral View

6 weeks follow up



Ap View

Lateral View

3 months follow up



Mortise View

Lateral View

6 months follow up



Ap View

Lateral View

Clinical photo results



Evaluation of pain

Pain Scale	Score	No Of Cases	
		3 Months	6 Months
No Pain	40	13(65%)	17(85%)
Mild, Occasional	30	7(35%)	3(15%)
Moderate, Daily	20	0	0
Severe, Always Present	0	0	0

All the patients at the end of 6 months were comfortable to do their day to day activities without any pain. Only three patients had occasional pain on doing strenuous activities. On an average 65% of the patients were able to do pain free activities as early as 12 weeks, while other patients were also able to do similarly at the end of 6 months.

Range of motion

Serial No	Movements	Average(Mean Plus Sd)
1	Dorsiflexion	17±1.788
2	Plantarflexion	30.5±1.466
3	Inversion	16.25±1.089
4	Eversion	16.45±0.920

At the end of 6 months all the patients had a normal range of movements, able to do their day to day activities. There was no stiffness or restriction of movements as mobilization was started early and physiotherapy was given adequately.

Functional outcome

S. No	Result	Score	Cases	Percentage
1	Excellent	>90	17	85%
2	Good	81-90	3	15%
3	Fair	60-79	0	0%
4	Poor	<60	0	0%

17 Cases (85%) had an excellent outcome.
3 cases (15%) had a good outcome

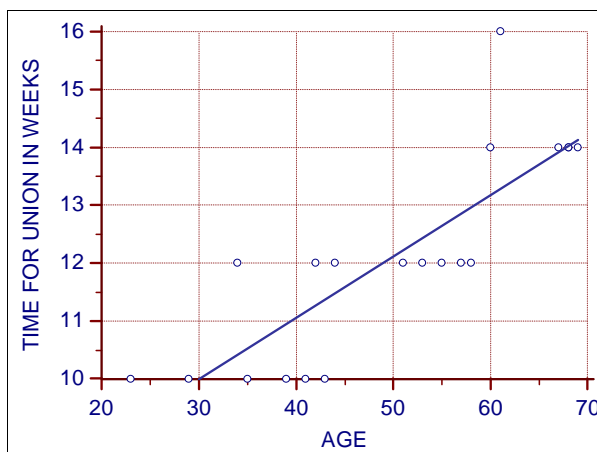
Statistics

1. Age vs time for union in weeks

	95% Confidence Interval for Mean					
	N	Mean	Std. Deviation	Std. Error	Lower Bound	Upper Bound
up to 40 years	5	10.40	.894	.400	9.29	11.51
41-60 years	10	11.80	1.135	.359	10.99	12.61
61 years & above	5	14.40	.894	.400	13.29	15.51
Total	20	12.10	1.774	.397	11.27	12.93

Time For Union In Weeks					
	Sum Of Squares	Df	Mean Square	F	Sig.
Between Groups	41.800	2	20.900	19.739	.000
Within Groups	18.000	17	1.059		
Total	59.800	19			

There is a statistically significant correlation between age of the age patient and the time taken for union.



**Scatter diagram
Correlation**

Variable Y	Time_For_Union_In_Weeks Time For Union In Weeks
Variable X	Age

Sample size	20
Correlation coefficient r	0.8290
Significance level	P<0.0001
95% Confidence interval for r	0.6105 to 0.9303

Regression

Dependent Y	Time_For_Union_In_Weeks Time For Union In Weeks
Independent X	Age

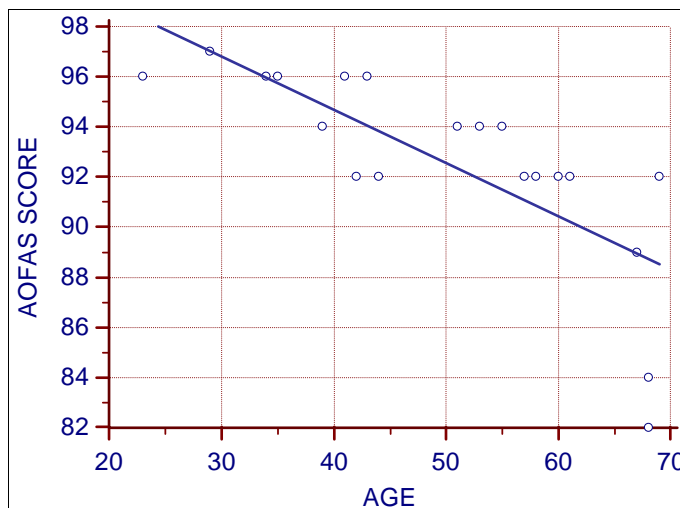
There exists a positive regression between age and time for union

2. Age vs Aofas Score

	Aofas Score					
	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean	
					Lower Bound	Upper Bound
up to 40 years	5	95.80	1.095	.490	94.44	97.16
41-60 years	10	93.40	1.647	.521	92.22	94.58
61 years & above	5	87.80	4.604	2.059	82.08	93.52
Total	20	92.60	3.885	.869	90.78	94.42

Anova					
Aofas Score					
	Sum of Squares	Df	Mean Square	F	Sig.
Between Groups	172.800	2	86.400	12.884	.000
Within Groups	114.000	17	6.706		
Total	286.800	19			

There is a statistically significant correlation between Age and the AOFAS score



Correlation

Variable Y	Aofas_Score Aofas Score
Variable X	Age

Sample size	20
Correlation coefficient r	-0.7587
Significance level	P=0.0001
95% Confidence interval for r	-0.8993 to -0.4759

Regression

Dependent Y	Aofas_Score Aofas Score
Independent X	Age

Sample size	20
Coefficient of determination R ²	0.5756
Residual standard deviation	2.6005

Scatter diagram indicates negative regression between age and AOFAS score. Greater the age lesser the score

3. Weber type fracture vs aofas score

	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean	
					Lower Bound	Upper Bound
2	13	91.77	4.400	1.220	89.11	94.43
3	7	94.14	2.193	.829	92.11	96.17
Total	20	92.60	3.885	.869	90.78	94.42

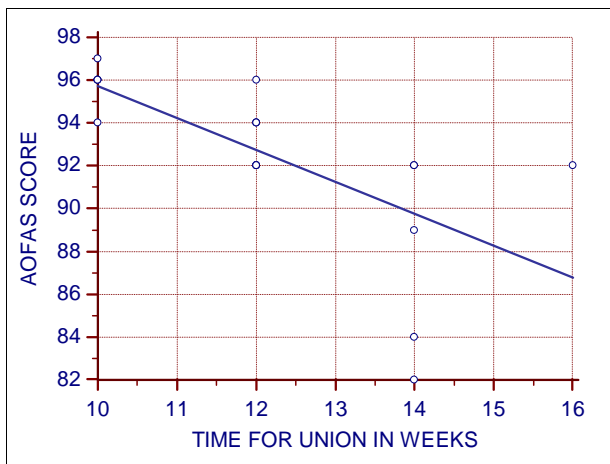
Aofas Score					
	Sum of Squares	Df	Mean Square	F	Sig.
Between Groups	25.635	1	25.635	1.767	.200
Within Groups	261.165	18	14.509		
Total	286.800	19			

There is no statistical significance between Weber type fracture and AOFAS score

**4. Time for union vs aofas score
Correlation**

Variable Y	Aofas_Score Aofas Score
Variable X	Time_For_Union_In_Weeks Time For Union In Weeks

Sample size	20
Correlation coefficient r	-0.6811
Significance level	P=0.0009
95% Confidence interval for r	-0.8634 to -0.3415



There is a statistically significant correlation between Time for union and AOFAS score. Earlier the union better the AOFAS scores.

Discussion

The important aspect of using a locking compression plate is the ability to use two different anchorage technologies by using a single implant. The LCP can be used either as a locked internal fixator or simply as a compression plate based on the patients requirement.

Conventionally bicortical fixation of the distal fibula has got three times the pull out strength when compared to unicortical purchase. Due to anatomical constraints the fixation of the distal periarticular region of the fibula should be restricted to unicortical screw application. When using conventional plating, such a unicortical fixation in the distal fragment will lead to increased rates of implant failure. When compared to the conventional plating techniques the use of LCP is independent of the bone mineral density status [5, 6].

Similar to external fixator, the LCP can function as a fixed angle construct. The fixed angle construct obviates the need of having compression effect between the plate and the bone. It also prevents toggling and screw back out happening due to micro motion, osteopenia induced by stress shielding effect.

One of the major concern in using a LCP for distal fibula fracture is the hardware prominence on the lateral side and chance of wound gaping and infection. Decreased operative time, adequate soft tissue cover with proper skin closure, providing adequate antibiotic cover, limb elevation and anti-edema measures post operatively has helped better in preventing wound related complications.

Studies have clearly shown that syndesmosis functions in a dynamic fashion during normal ankle motion. During motion fibula descends distally, laterally with a rotational component. This has led to the fixation of syndesmotoc injuries which maintains the dynamic properties of the joint.

The ideal implant to be used for syndesmotoc injuries should prevent late diastasis and help in early return to activity. The need for implant removal, chances of screw breakage and related complications can be avoided by using the suture button as the fixation device

With regards to the complication in our study, one case underwent similar fixation of the distal fibula and syndesmotoc fixation. The patient was having uncontrolled diabetes mellitus and did not come for periodic follow up as advised. Patient developed superficial infection for which culture specific antibiotics were given, and infection controlled after 2 months. He had repetitive infection in surgical scar site followed by a formation of a sinus which was controlled by antibiotics alone. Implant exit was done finally. Patient did not have any functional limitations and was able to do his day to day activities without any hindrance. At the end of 6 months his AOFAS score was 82. This was the lowest score observed in our study.

The application of the suture button is an easy procedure without any technical difficulties and no additional special device is required except an introducer. The suture is unlikely to fatigue easily, hence implant removal is routinely not required. The patients can begin their rehabilitational activities at an earlier stage as the suture device exactly simulates the role carried out by the ligaments.

Summary

At the end of the study we had 20 cases in the follow up stage out of which 12 were male and 8 were females. The average age of the cases was 49.5 years ranging between 23-68 years. The mean of the time taken before surgery was 4.77 days (range 2-14 days).

The commonest fracture pattern was that of Weber type B with 13 cases with the remaining 7 cases being Weber type C fractures.

The most common associated fracture was a medial malleolus fracture in 18 cases of various patterns, one case had an associated distal fibula fracture and on case had an isolated fibula fracture alone.

All the cases achieved radiological union and resumes their activities at an average of 12.1 weeks with a range between 10-16 weeks.

The average AOFAS score was found to be 92.6 with scores ranging from 82-97.

17 cases had excellent outcome and 3 cases had good outcome.

No routine removal was done for any of the cases, none of the cases had any intraoperative complications during the procedure.

One of the patient postoperatively developed a superficial skin infection due to poor hygiene which was controlled by good wound care and intravenous antibiotic cover. However the patient due to poor hygiene and uncontrolled diabetes mellitus repeatedly got superficial infection and finally implant removal was done for the patient after signs of radiological union was observed.

However that patient did not have any functional disability. He did not have any disabling pain and was able to do his day to day activities with mild discomfort. He was able to achieve an AOFAS score of 82.

No other major complications were observed intra-operatively and post- operatively. No case was reported to have any activity restriction or a fair or poor outcome.

None of the cases were reported to have any neurovascular complications, non-union, malunion and implant failure.

Conclusion

The fixation of distal fibula fractures with syndesmotic injury with anatomical Locking compression plate and syndesmotic suture button fixation is an effective method of fixation in view of

- Excellent fracture union
- Early rehabilitation
- Better fixation in comminuted and small distal fragment.
- Better fixation in osteoporotic bones
- Improved ankle stability
- Avoidance of syndesmotic screw related complications
- Lesser morbidity
- Fewer complications

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