

**Evaluation of healing morphology of fractured condyle after closed reduction and its association with functional impairments**

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**Abstract**

**Background and Objectives:** Closed reduction is one of the oldest treatment modalities for condylar fractures. Depending upon the type of fracture, the healed fracture site presents with different morphological pattern. There morphological pattern were analysed using Three Dimensional Computed Tomography (3D-CT) image. The objective of our study was to evaluate the morphological healing pattern of condylar fracture after

closed reduction and to clinically evaluate its association with functional impairments after healing.

**Methods:** 15 patients presenting with condylar fracture were included in the study. Intermaxillary fixation was done using Erich’s arch bar and elastics for a period of 3 weeks. After removal of IMF, active mouth opening exercises were advised. 3D-CT scan was done pre-treatment and post-treatment for the assessment of healing pattern of condylar fractures. Its relation to

functional impairment was evaluated. The parameters assessed were; amount of jaw deviation, amount of mouth opening, occlusion and pain after 1st month, 3rd month and 6th month.

**Results:** 8/15 patients had L-shaped pattern of healing, 5/15 patients had unchanged pattern, 2/15 patients had spherical pattern, 0/15 patients had detached pattern. 100% patients (2/2) with spherical pattern had reduced mouth opening at the end of 6 months. One patient with L-shaped pattern had anterior open bite after 3<sup>rd</sup> and 6<sup>th</sup> month. At the end of 1<sup>st</sup> month, 50% of patients with L-shaped pattern (4/8), 20% of patients with unchanged pattern, 50% of patients with spherical pattern (1/2) had pain.

**Conclusion:** Closed reduction provides satisfactory management of condylar fracture without any significant functional impairment. Pain & functional impairment may be encountered in displaced fractures which heal with loss of normal morphology. However, the same gets corrected over a short period of time.

**Keywords:** Condylar Fracture, Healing Pattern, Functional Impairment, 3D-Evaluation, IMF

### Introduction

Treatment of condylar fractures has generated more discussion and controversy than any other fracture in the field of maxillofacial trauma [3]. Closed reduction is one of the oldest treatment options. The choice of the treatment depends on clinical and radio graphical evidence of the fracture, fracture site, pattern and degree of displacement of fracture fragment [1]. If the condyle fracture is immobilised while condyle is still dislocated or deviated it heals in the different morphological pattern which can be assessed using 3D-CT images.

The main objective of this study was to evaluate the healing morphology of fractured condylar fragment and its association with functional impairments such as pain,

amount of deviation, amount of mouth opening and occlusion.

### Materials and Methods

A prospective study was conducted on 15 patients, with condylar fracture of mandible and was managed with closed reduction. Patients underwent routine diagnostic investigations before the treatment. 3D-CT scans were taken pre-treatment and 6 months after post-treatment. Patients who had unilateral condylar fracture, in the past one week, in the age group of 20 to 60 yrs were included in this study. Patients with bronchial asthma, head injury, epilepsy were not included for the study.

Closed reduction was done using IMF and elastics approximately for 21 days & followed by active mouth opening exercises. Functional impairments such as pain was assessed using Visual Analogue Scale (VAS), amount of deviation by checking midline shift, amount of mouth opening by measuring maximum interincisal distance, occlusion by taking pre - treatment & post - treatment photographs was assessed after 1st month, 3rd month & 6th month.

3D-CT scan was taken before treatment to assess fracture site and 6 months after treatment, to evaluate the healing pattern of condylar fracture and classified into 4 patterns unchanged (fig -1 A), L shaped(fig -1B) , spherical shaped (fig -1C) and detached pattern of healing.

Statistical analysis was done by one way ANOVA to find the 'p' value. To know statistical significance between healing patterns of condylar fracture Tukey post hoc test was done.

### Results

Based on healing morphology, 3D-CT images of post healing condylar fractures were classified into L-shaped pattern, spherical pattern, unchanged pattern, detached pattern of healing. It was noted that association of

healing of condylar fracture and its pattern fracture site in 3D-CT images, fracture of head of condyle healed in spherical pattern, neck fracture of the condyle healed in spherical or L-shaped pattern and comminuted fractures of condylar neck healed in spherical, L-shaped pattern or detached pattern[3].

Out of 15 patients, 8 patients had L-shaped pattern, 2 patients had spherical shaped pattern, 5 patients had unchanged pattern. None of the patient had detached pattern of healing.

Pain was assessed using VAS. Patients were asked to score from 0 to 10 on scale, where 0 was considered as no pain, 1 to 3 as mild pain, 4 to 6 as moderate pain and 7 to 10 as severe pain. Pain was found only after the first month post-treatment in all the three type of patients.

Amount of jaw deviation was assessed by checking the midline shift. It was found only in the patients with L-shaped and spherical shaped healing pattern. 25% of patients (2/8) with L shaped & 100% of patients (2/2) with spherical healing pattern had jaw deviation of 5 mm after 1st month of follow up, with 'p' value of 0.083 & 0.157 respectively which was statistically not significant. Jaw deviation of both patients with L shaped and spherical shaped healing pattern was reduced over a period of 3<sup>rd</sup> month with a 'p' value of 0.317 & 0.157 respectively which was statistically not significant. And it was reduced to normal over a period of 6 months in patients with both type of healing pattern. Patients with unchanged healing pattern had no jaw deviation. ( refer table -1)

Mouth opening was assessed by measuring maximum interincisal distance. Maximal interincisal distance of 35 mm and above was considered as normal. All patients with unchanged healing pattern had normal mouth opening with statistical significant 'p' value of 0.041 after 1st month & 0.042 after 3rd month & 6th month as

well which were statistically significant. Patients with L-shaped healing pattern also had normal mouth opening with a 'p' value of 0.017 after 1st month, 3rd month & 0.011 after 6th month which was statistically significant. All patients with spherical shaped pattern, had less than 35 mm of maximum interincisal distance with a 'p' value of 0.180 after 1st month, 3rd month & 0.317 after 6th month, which were statistically not significant. All patients were satisfied with their maximum amount of mouth opening after 6 months post treatment.

Occlusion was normal in all the patterns of healing, except one patient with L shaped healing pattern who had anterior open bite after 3rd and 6th month post-treatment.

### Discussion

Fracture of mandibular condyle occurs as a consequence of indirect blow when the external force impact is in the anterior-posterior direction and from below upwards upon chin. When a direct blow such as a moving object strikes the region of the joint forcibly, the head of the condyle impinges upon the glenoid cavity, resulting in fracture which occurs at the narrow section of the condyle and below the insertion of the external pterygoid.[4]

The clinical presentation of unilateral condylar fracture with dislocation or displacement includes ipsilateral premature posterior teeth contact and deviation of mandibular midline to the affected side, where as unilateral condylar fracture without dislocation presents as mandibular midline deviation to contra lateral side with inability to occlude on affected side. [4]

The main objectives of condylar fracture treatment are to achieve maximum interincisal distance of 35 mm or more, painless mouth opening, good mandibular movements in all excursions, to restore occlusion, to stabilize TMJ, and to achieve good facial symmetry [1]

The treatment of condylar fracture, whether open or closed reduction depends on many factors including clinical and radiographical evaluation, extent of the fracture whether unilateral or bilateral, level of fracture, degree of displacement and dislocation of the fractured condyle, occlusal derangement, mandibular dysfunction, posterior occlusal support, experience of the surgeon, willingness of the patient for surgery [ 5].

Closed treatment is opted most frequently, since it permits early mobilization and adequate stimulation of condylar growth in growing subjects and bone remodelling in all the subjects. It is indicated in all the condylar fractures that occur in childhood and in intracapsular and extra capsular condylar fractures without serious condylar dislocation in adults[6,7] Closed reduction can be the treatment of choice unless fractured condyle is displaced in the middle cranial fossa, lateral extra capsular displacement or if there is any foreign body invasion.

However, closed reduction does not provide necessarily adequate anatomical reduction of fractured condylar segment. This may result in varying morphological pattern following healing. Depending on the morphological pattern patients may present with varying functional impairments. This study was undertaken to evaluate the impact of various morphological pattern on function. The morphological patterns were studied and classified using 3D-CT images.

Mayer et al [8] in their study, compared 3D-CT with conventional CT scan and found that 3D-CT provided benefits of greater definition of fracture line and extent of comminution, course of fracture line, number and size and also displacement of fracture segments can be better appreciated. Surgeons were able to plan and place inter-fragmentary wires and plates in a better way. Similar study was done by Yamashita Y et al [9] on healing

morphology of condylar fracture after closed reduction. They attempted to classify the fractured segments using conventional CT scan but it was not possible to classify in the same way as 3D- CT scan can classify. The L-shaped pattern and detached pattern were difficult to identify in the conventional CT scan.

In present study, condylar base fractures healed in unchanged pattern, a fractured fragment which was in contact with fractured ramus end healed in spherical pattern, fractured fragment which is medially pulled by the lateral pterygoid healed in L-shaped pattern. Since none of the patient had detached pattern of healing its assessment was not possible.

All functions were normal in unchanged pattern of healing. L-shaped pattern showed pain in (4/8) 50% of patients, (2/8) jaw deviation 25% of patients, occlusion was normal except a patient who had anterior open bite, patients were satisfied with amount of mouth opening. Whereas in spherical shaped pattern, jaw deviation was seen after 3 months, with limited mouth opening, pain was present in first month with normal occlusion.

Pain was present in the first month in all pattern of healing. Pain may be due to difference in the shape of condylar segment in the TMJ. It may take few months for the patients to re-establish occlusal harmony and for the masticatory muscles to adapt. Muscle training may have important role in this phenomenon [10].Jaw deviation again was seen in patients with changed condylar morphology resulting in improper translation of the condyle. It may also be compensatory movement of contra lateral condyle to open the jaw with muscle pull may deviate the affected fracture site. There was significant improvement in the mouth opening of patients which was followed by mouth opening exercises.

The present study suggests that 3D imaging enables us to study morphological healing patterns of fractured condyle after treatment. Closed reduction has good treatment outcome with minimal functional impairment seen in the early follow up period, which generally returns to normal within 3 to 6 months.

**Conclusion**

Closed reduction can be a choice of treatment in patients with condylar fractures with resultant minimal or no functional impairment. 3D-CT imaging is a good modality in visualizing the type of fractures, their healing pattern and anticipating amount of functional impairment that may be experienced by the patients in the early treatment period.

Fig. 1: Morphological Healing Pattern

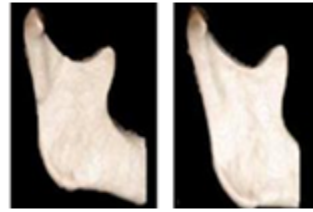


Fig. A: Unchanged Pattern

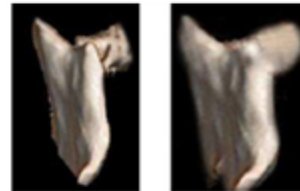


Fig. B: L-Shaped Pattern

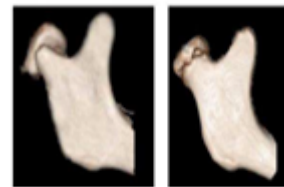


Fig. C: Spherical Pattern

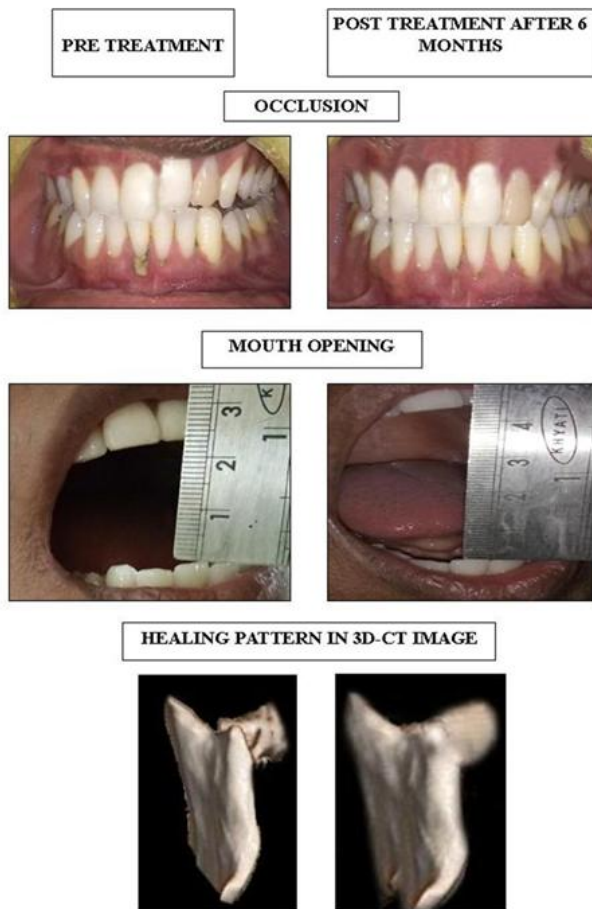
Table 1: Healing Patterns and Its Association with Functional Impairments.

Pt Si. No	Healing Pattern	1st Month				3rd Month				6th Month			
		Pain	Amount of jaw deviation (mm)	Mouth opening in mm	Occlusion	Pain	Amount of jaw deviation	Mouth opening in mm	Occlusion	Pain	Amount of Jaw deviation	Mouth opening in mm	Occlusion
1	U	0	0	40	N	0	0	42	N	0	0	42	N
2	L	0	5	42	N	0	2	43	D	0	2	43	D
3	L	3	5	40	N	0	0	43	N	0	0	43	N
4	Sp	2	5	22	N	0	3	30	N	0	0	30	N
5	U	3	0	42	N	0	0	44	N	0	0	44	N
6	L	0	5	35	N	0	0	35	N	0	0	38	N
7	L	2	0	40	N	0	0	42	N	0	0	42	N
8	L	3	0	36	N	0	0	38	N	0	0	38	N
9	U	0	0	38	N	0	0	40	N	0	0	40	N
10	U	0	0	38	N	0	0	42	N	0	0	42	N
11	L	0	0	42	N	0	0	42	N	0	0	42	N
12	L	0	0	40	N	0	0	42	N	0	0	42	N
13	L	2	0	37	N	0	0	39	N	0	0	41	N
14	U	0	0	45	N	0	0	45	N	0	0	45	N
15	Sp	0	5	29	N	0	3	32	N	0	0	35	N

Note- L: L-shaped healing pattern, S: Spherical healing pattern, U: Unchanged healing pattern, N: Normal, D: Deranged occlusion.



Fig. 2: Pre-Treatment and Post Treatment Figures Showing Healing Pattern and Its Functional Impairments.



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