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RESEARCH ARTICLE

EFFICACY OF ENDOSCOPY ASSISTED vs. TRADITIONAL ORIF OF CONDYLAR FRACTURES

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ABSTRACT

Condylar fractures are the most common accounting from 9-45 % of all condylar fractures. They can be managed conservatively or by surgical modalities. The advent of the Endoscope in Surgery was an innovation which soon found its way into Maxillofacial Surgery. The aim of this systematic review was to evaluate the efficacy of endoscopy assisted ORIF vs. traditional ORIF in the treatment of condylar fractures. Information was collected using electronic data sources such as PubMed and Google scholar. 1. The inclusion criteria were studies published in english comparing the Endoscopy assisted ORIF with traditional ORIF for treatment of patients suffering from mandibular condylar fractures. Studies published between 1st January, 1995 and 31st December, 2015 were included. 2. The exclusion criteria were non availability of full length articles and the articles that were not published in english. Patients suffering from condylar fractures were treated with either endoscopy assisted ORIF or traditional ORIF technique. Out of all the articles screened 2 studies were selected after removing of duplicates and assessing full length articles. The studies revealed that both endoscopic approach and traditional ORIF approach comes with their respective set of pros and cons and neither can be called better than the other at this point. The primary limitation encountered during the review was that there are very few studies conducted comparing the Endoscopic and non endoscopic ORIF techniques. The sample sizes in these studies are small and hence it becomes difficult to draw a conclusion regarding the results. Associated with them. Reviewing the current available literature makes the comparison between the two approaches inconclusive. Both the traditional and endoscopic approach for ORIF have comparable results and more studies need to be conducted to compare the two. Once the drawbacks associated with Endoscopy assisted approach are overcome, it can be used by more number of surgeons including the developing countries.

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INTRODUCTION

It has been documented in literature that closed reduction of condylar fractures with MMF provided the most favourable results. (MacLennan, 1952; Blevins and Gores, 1961; Goodsell, 1947) Assertive statements from the 1950s further strengthened the belief (MacLennan, 1952). As anaesthesia advanced and refinements in hardware took place, open reduction with rigid internal fixation (ORIF) has evolved as a popular method of choice. Literature has provided with comparisons which document superior results over closed reduction. (Haug and Assael, 2001; Hidding *et al*., 1999; Oezmen *et al*., 1998; Worsae and Thorn, 1994; Throckmorton and Ellis, 2000) Condylar fractures are common accounting for 9-45 % of all mandibular fractures. (Schuchardt and Metz, 1966; Tasanen and Lamberg, 1976) The management options include either the conservative or surgical modalities. Conservative management i.e closed reduction has been advocated predominantly due to problems of difficulty of access, scarring, risk of facial nerve injury and salivary fistulas to name a few. Anatomic reduction remains impossible to achieve, but the function of the TMJ depends on the altered morphology of the condyle. The advent of miniplate fixationavoided the need of MMF. The condyle can be accessed by various approaches like submandibular approach (Alexander *et al*., 1994) or the pre-auricular approach (Raveh *et al*., 1989). The various advantages of the retromandibular approach have been documented as a shorter working distance from skin incision to the condyle, better access to the posterior border the mandible and sigmoid notch, less conspicuous facial scarring and easy reduction. (Ellis and Dean, 1989) With the trend of minimally invasive surgery, the endoscope found its way into Maxillofacial surgery for the purpose of fixation condylar

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fractures. The endoscopic approach for treatment of subcondylar fractures have been reported by many over the past few years. Endoscope-assisted transoral open reduction and internal fixation (EAORIF) has gained popularity for the treatment of mandibular condyle fractures. As the number of surgeons using this technique increases, it adds to the controversy surrounding the choice of treatment for management of fractures of mandibular condyle. While much has been said about open reduction and internal fixation, endoscopy-assisted approach still remains comparatively unknown to a large group of surgeons especially in the developing or the under developed countries. The endoscopic technique works best on fractures without comminution in which there is enough bone above the fracture to accommodate two screws in a plate. Although achieving anatomic reduction becomes possible with this technique, the limited visibility of the fracture site due to the coronoid process along with the steep learning curve in this area continues to pose as a challenge. Therefore, the aim of this systematic review was to compare the efficacy of the non-endoscopic ORIF with the endoscopy assisted ORIF for the treatment of fractures of the mandibular condylar process.

MATERIALS AND METHODS

Focussed Question

Is endoscopy assisted ORIF better than conventional/ traditional ORIF approach for the treatment of condylar fractures?

Study Objective

To evaluate the efficacy of endoscopic approach for the treatment of condylar fractures as compared to traditional methods of treatment.

Eligibility Criteria

1. Studies published between January 1st, 1995 to December 31st, 2015.
2. Clinical trials, Case reports

Exclusion criteria-

1. Non-availability of full length articles despite communication with authors
2. Articles not in English.

Study Variables

Participants- Patients with displaced uni/bilateral condylar fractures.
Intervention- Treatment of condylar fractures.
Comparison- Between EAORIF vs. ORIF
Outcome- Evaluation of efficacy of endoscopic approach as compared to traditional ORIF

Database search and search strategy

Multiple internet sources were used in the search of appropriate articles satisfying the purpose of the study. The PubMed databases (Medline database, free open access of PubMed central and free full text articles) and the Cochrane databases (the Database of Abstracts of Reviews of Effects and the central register of controlled trials), Google Scholar, Google and manual search using DPU college library resources were used. All cross reference lists of selected studies were screened for additional papers that could meet the eligibility criteria of the study. English language limit was applied. Only studies carried out on humans were included. The databases were searched for studies carried out from 1/1/1995 to 31/12/2015 using the search strategy.

Table 1. List of keywords used in the search strategy

Keyword	Synonyms
Endoscopy	Endoscopy, Endoscopic assisted, Navigation surgery
Condylar fractures	Mandibular fractures, fractures of lower jaw, Subcondylar fractures
Treatment	Reduction & fixation, Immobilisation, Functional rehabilitation, subcondylar fracture treatment, ORIF
Comparison	Conventional vs. Endoscope assisted, endoscopy assistance and extra oral approach
Approach	Surgical access, Retromandibular approach, extra oral approach, Conventional approach

Study Selection

Preliminary screening consisted of a total of 45 articles out of which 2 articles were selected. The papers were screened independently by Dr. GL and reviewed by Dr. PW. At first the papers were screened by title and abstract. As a second step, full text papers were obtained when they fulfilled the criteria of the study. Any disagreements between the two reviewers was resolved after additional discussion. For full text screening, the following criteria was taken into consideration: randomised control trials, clinical trials, case reports and the keywords in their various permutations and combinations. After the full text articles were reviewed, cross references were checked and a total of 2 articles were found and included in the study.

Data Collection Process

A standard pilot form in excel sheet was initially used. Data extraction was done for one article and this form was reviews by an expert and finalised. This was followed by data extraction of the remaining article.

Data Items Included

1. Location - The city/country where the study was conducted
2. Author- The names of the authors who conducted the study.
3. Year of publication- Year in which the study was published
4. Study design- Randomised control trial/Retrospective clinical study/ case report
5. Sample size- Number of patients included in the study
6. Setting- Hospital/Maxillofacial department
7. Population- The group of patients included in the study
8. Intervention- The treatments that were given i.e Conventional ORIF
9. Comparison- Endoscopy assisted ORIF
10. Operating time- Time taken for completion of each of the procedures
11. Complications- Complications encountered with both approaches
12. Results
13. Remarks

Search strategies used

S. No.	Search strategy	Number of articles found	Number of articles selected	No. after duplicate removal
1	Endoscopy AND Condylar fractures AND Treatment AND Comparison AND Approach	0	0	0
2	Endoscopy AND Condylar fractures AND Comparison AND Approach	0	0	0
3	(Endoscopy OR Endoscopic assisted OR Navigation surgery) AND (Condylar fractures OR Fractures of the lower jaw OR Subcondylar fractures) AND (Treatment OR Reduction & fixation OR Immobilisation OR Functional rehabilitation OR subcondylar fracture treatment) AND Comparison AND (Approach OR Surgical access)	2	1	0
4	Endoscopy assisted AND Mandibular fractures AND Reduction & fixation	28	2	0
5	Endoscopy AND Mandibular fractures AND Functional rehabilitation AND Surgical access	0	0	0
6	Condylar fractures AND Approach AND Immobilisation	4	0	0
7	Endoscopy AND Mandibular Fractures AND Comparison	3	0	0
8	Navigation surgery AND Subcondylar fractures AND Treatment	0	0	0
9	Endoscopy AND Mandibular fractures AND Treatment	0	0	0
10	Other sources	8	2	2
	Total	45	5	2

DISCUSSION

Of all the anatomical sites, the mandibular condyle is most prone to fracture accounting for 30% of all mandibular fractures. (MacLennan, 1952) Various surgical approaches for the ORIF of condylar fractures have been reported in the literature. The addition of the endoscopy assisted ORIF to this list has only added to the controversy surrounding the choice of treatment modality for the same. Both Endoscopy-assisted Open Reduction Internal Fixation (EAORIF) and conventional technique of ORIF have their own set of advantages as well as disadvantages. The criteria for success of the treatment of mandibular condylar fractures are re-establishment of a pre injury occlusion, pain free jaw opening of >40 mm, good excursion of the jaw in all directions, minimal facial scarring and facial symmetry. (Miloro, 2004) The indications for open reduction of condylar fractures have been clearly documented. (Zide and Kent, 1983) In his discussion of Haug and Assael's article[4] about the outcomes of open versus closed reduction of mandibular subcondylar fractures, Zide discussed that there are only two real indications for open reduction of the mandibular condyle and they are condylar displacement and ramal height instability. (Haug and Brandt, 2004) For the sake of our comparison we have considered that the studies included in this review abide by these indications. To make an appropriate comparison between the conventional method of ORIF and endoscope assisted ORIF, one should discuss multiple parameters applicable. The first parameter to consider would be the type and location of the incisions made for the respective approaches. Submandibular, preauricular or retromandibular incision can be given for extraoral approach although retromandibular incision is now preferred due to its proximity to the fracture site. Whereas in the Endoscope-assisted approach, either an intraoral or a transfacial incision can be used. The intraoral incision is more or less like the one made for the sagittal split osteotomy which is made in the region of pterygomandibular raphe. Other variables that need consideration are, stability of the fracture segments on fixation, anatomic reduction, functionality of the TMJ post surgery, operating time and bleeding. Acrucial parameter that needs attention would be the postoperative facial nerve involvement. It has been as a frequent occurrence with the conventional methods of open reduction. Some advocates of the endoscope assisted approach have suggested that the plate used for fixation with the endoscope should be malleable enough to allow adaptation to the bone during the endoscope application for fixation. But it was noticed that malleable/weak plates only lead to failure of the treatment due to deformation or failure during function thus needing to be operated again to stabilise the fracture segment (Hammer *et al*., 1999).

The patient benefit from endoscopically assisted fixation of condylar neck fractures was evaluated (Schmelzeisen *et al*., 2009). It was a randomized control trial consisting of 74 patients operated at 7 different trauma centres. The selected patients had either uni- or bilateral condyle fractures with either displacement of 30^0 or more or severe functional impairment such as malocclusion or an open bite; with or without dislocation of the condylar fragment; severe pain on palpation or movement; and/or vertical shortening of the ascending ramps due to condyle fracture. Patients were randomly allotted to either trans-buccal insertion of screws (ENDO group) or open reduction with endoscopic assistance (ORIF group). Asymmetric Helkimo dysfunction score (Schmelzeisen *et al*., 2009) was used to evaluate the functional outcome after the surgery. The measures for secondary objectives includes variables like: Operation time, cosmetic outcome, facial physiognomy, intra and post operative complications. Of the 74 patients, 34 were in the ORIF group and 40 were randomized into the ENDO group. Post-operatively fracture reduction was evaluated using panoramic x-rays and Towne's views or Computed tomography immediately after surgery and at all follow up visits. The mean operating time was seen to be 33 minutes faster for the ORIF group than the ENDO group (53.5 minutes and 86.5 minutes) respectively. 10 of the ORIF patients required MMF for a average of 6.5 days whereas 9 patients from the ENDO group required MMF for an average of 7 days. The difference seen between the two was not significant. No difference was found in the functional outcomes between the two groups at 8-12 week or 1 year followup. A number of complications were encountered with both the groups but they were also more or less similar in nature and hence no one group proved to be superior. For the ORIF group pain, implant breakage, infection, haematoma and hypoesthesia were observed. One of the patients in the ENDO group suffered from inadequate reduction, non union was seen in 1 patient; superficial infection in 2 and 2 cases of swelling were noted. Facial nerve damage was seen in one patient from each of the groups. The patients in the ORIF group of this study reported less satisfactory cosmetic results due to the extra oral approach taken. Results show that comparable functional results were achieved.

Shinnosuke Nogami *et al*. (2012) conducted a study between July 2006 and September 2011 at Kyushu Dental College, Japan. 30 patients with mandibular condyle fracture were

included in the study of which 15 were treated with Retromandibular approach for the ORIF and the other 15 were treated with Endoscopy assisted open reduction internal fixation (EAORIF). Patients were followed up at 1,3 and 6 months. The parameters considered for evaluation were fracture line, fracture type, number of plates used, surgical duration, amount of bleeding, duration of MMF, postoperative elastic therapy duration; functional items such as maximal inter incisal opening, deviation of the mandible, malocclusion, facial paraesthesia, TMJ pain and clicking. On evaluation it was seen that in the RM group; deviation, displacement, deviation and dislocation were all see in 4 patients each. Whereas, displacement with dislocation was seen with 1. In the EAORIF group, cracking was seen in 5 patients, deviation in 7 and displacement in 3. The average surgical duration showed no statistical difference with time required being 103 minutes and 111 minutes for RM and EAORIF group respectively. The average bleeding amount was 68 ml in the RM group and 10 ml in the EAORIF group. The duration of maxillomandibular fixation and postoperative elastic therapy duration were observed to be similar in both groups. Facial paraesthesia was observed in 47% of the patients in the RM group. TMJ pain was observed in both the groups 1 month after surgery. Also, TMJ pain was a common feature in both the groups at the 1 and 6 months follow up after surgery. Considering all the parameters and functional items, it was seen that both the groups showed good and comparable results and no method could be graded better than the other.

Lütfi Eroglu *et al* in 2013 published a study regarding the synergy between endoscopy assistance and extraoral approach in subcondylar fractures. Although this article does not match the criteria for inclusion in the study, it has been mentioned for the purpose of completion of this investigation. In this study 15 subcondylar fractures were treated in 13 patients, two of who had bilateral fractures. Here all the fractures were intended to be treated with endoscopic approach but open reduction was used as a bail out procedure in patients who's fractures could not be fixed endoscopically. Mean operating time for EAORIF was seen to be 150 minutes. 6 of the 15 fractures had to be treated by the bailout option of open approach. Facial nerve weakness was seen in 1 out of the 9 patients treated endoscopically. This study concluded that an extra oral approach for endoscopy assisted ORIF is practicable and can be performed with decreased morbidity. Proper communication with the patient regarding a possibility of a bail-out procedure during the same surgery or at a later stage is vital.

Location

The two studies included in the review were carried out at different geographical locations. What is interesting to know is that both studies were in developed countries with huge technological advancements, namely Germany and Japan.

Year of publication

The studies were published in 2009 and 2012. Since endoscopic approach was relatively new, there must have been a significant learning curve associated with it. It is interesting to know that there are only 2 papers comparing the two approaches.

Study design

The 2009 study was a randomised control trial carried out in 7 different trauma units. Whereas, the 2012 study was a retrospective clinical study.

Sample size

The sample size of both our studies was 74 and 30 respectively. This is an adequate number of patients when considered as a standalone number but in view of the surgical technique, it may be less than adequate. The same has been quoted by the authors. (Schmelzeisen *et al*., 2009)

Setting

All the studies were carried out in a hospital setting as the patients needed to be hospitalised prior to surgery.

Population

All patients irrespective of ethology of trauma having uni/bilateral condylar fractures were a part of the studies.

Intervention

The patients were randomly divided into 2 groups. The interventional group comprised of traditional/conventional ORIF technique.

Comparison

Patients were then compared to the transoral endoscopic approach.

Operating time

The mean operating time between the two studies showed significant variation. In the 2009 series, the mean operating time for traditional ORIF group was 53.5 minutes and for the endoscopy assisted group it was 86.5 minutes. The Japanese study showed a mean operating time of 103 minutes for the open approach and 111 minutes for the Endoscopic approach group. It is interesting to note that in the German study, the endoscopic approach took just 30 more minutes than the conventional approach while, the Japanese study showed that the endoscopic approach too only 8 minutes longer.

Complications

Both studies showed more or less the same complications like deviation of mandible, TMJ pain and clicking which were the most common complications after the endoscopic procedure. Both studies showed similar complications after the traditional ORIF approach like pain, facial nerve paraesthesia.

Limitations

After reviewing the available literature comparing the conventional ORIF technique with the Endoscopy assisted open reduction and internal fixation, it is observed that the prime limitation of these studies is the sample size. The sample sizes considered in the literature that qualified for inclusion in the study in question are all small in number. It is difficult to

conclusively state the statistical significance of the findings derived from the minuscule data available. The number of studies carried out comparing the two approaches is inconsequential; thus making the choice debatable.

Conclusion

An overview of the current literature within the limitations of this investigation regarding the comparison between the two approaches for the surgical treatment of condylar fractures, it is seen that although endoscopic approach offers great potential in terms of fewer complications and a marginally better aesthetic outcome; it also needs intensive training. The cost involved in endoscope assisted surgeries is much higher than the traditional method of ORIF. Both the approaches of ORIF of the mandibular condylar fractures provide stable and uniform results with only slight variation in factors such as facial nerve paresthesia and the scar formation. But at the same time it also increases the operating time as it takes longer to perform the EAORIF. In the hands of an experienced surgeon, traditional method of ORIF is observed to be accomplished sooner than the other approach. Extensive and thorough training in endoscopic techniques is mandatory before this approach can be attempted or performed. Hence, considering the current scenario it is safe to say that no approach can be called better than the other.

Future Implications

Endoscopy assisted open reduction and internal fixation of condylar fractures is rapidly becoming a popular choice of treatment amongst surgeons across the world. With its advent in the developing or underdeveloped countries it could be further utilised after a thorough training programme for the trainee surgeons and even the well experienced ones. The operating time could thus be reduced marginally, leading to decrease in cost to a great extent. The price of the equipment required is a major hurdle for use specially in the developing parts of the world. But, with the disadvantages of EAORIF overcome in the future, we may be at the dawn of the era of Endoscopy assisted open reduction and internal fixation as the treatment of choice for condylar fractures.

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