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To Assess the Effectiveness of Endoscopic Management of Condylar Fracture and Compare It with Open Reduction Internal Fixation –A Systematic Review

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ABSTRACT

Background

Treatment modalities for condylar fractures of the mandible includes closed reduction, open reduction–internal fixation and functional therapy.[1]Here we systematically review the studies assessing the effectiveness and complication of endoscopic-assisted mandibular condyle fracture management and their comparison with open reduction –internal fixation.

Methods

A total of 14 articles were selected based on our exclusion and inclusion criteria from PubMed, Research Gate and clinical trials.gov. Outcomes like incisal opening, facial nerve weakness,TMJ pain, occlusion are qualitatively compared based on standard values.

Results

Except for facial nerve weakness and operating time there was no significant parameter difference between open versus endoscopic management of condylar fractures. All other parameters gave approximately similar results. Endoscopic approach is more technique sensitive and also the acquisition of equipment, related hardware, and maintenance being challenge.

Discussion

There is not any go to approach for condylar fracture, but each patient needs to be fully evaluated preoperatively both structurally, functionally, age, general health status and the more convenient approach needs to be selected for each case. Open reduction indicated in Moderate to severe displacement with considerable ramus height shortening . Endoscopic approaches for condyle fractures are more technique sensitive. We concluded that further clinical studies are necessary for endoscopic management of condylar fractures.

I. INTRODUCTION

Condylar fractures management in maxillofacial trauma is a questionable topic.By now the treatments areadvocated for adult condylar fractures:Closed reduction with Intermaxillary fixation followed by the functional rehabilitation by physiotherapy, only Functional therapy without Maxillomandibular-fixation,Open-reduction internal fixation with or without maxillomandibular-fixation [MMF],Open reduction with endoscopic approach.According to recent concepts, fractures withshortening of the ascending ramus of more than 2 mm and a deviation of more than 10◦, or a should be treated with open reduction and fixation, regardless of the level of the fracture. Conventional extraoral accesses such as retromandibuar, submandibularandpreauricular incisions can easily injure the facial nerve and can cause unesthetic scars.

II. MATERIALS AND METHODS

This systematic review was methodical and conducted according to the Preferred Reporting of Systematic Reviews and Meta-analyses (PRISMA) statement.

What are the effectiveness of endoscopic management of condylar fracture in comparison to open reduction?

1. Types of Studies:

This systematic review scrutinized case series and randomized controlled clinical trials with the minimum of 3 months follow up period. The research question was done by using the PICO format (P- patient or population, I- intervention, C-comparison, O-outcome)

2. Types of Study Representatives:

The participants included in the studies were aged between 18 to 81 years. They were diagnosed with mandibular condylar fracture and treated with transoral endoscopic-assisted technique and surgical open reduction & internal fixation technique.

Intervention group are participants receiving endoscopic-assisted ORIF technique of mandibular condylar fracture.Control group are participants receiving for submandibular or retromandibular approach ORIF of mandibular condylar fracture.

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3. Types of Outcomes/Measures:

Outcomes measured can be listed as follows:
Clinical parameter
Occlusal disturbances, Mean incisal opening, Deviation on opening, protrusion, laterotrusion right, laterotrusion left, nonunion, condylar reabsorption, Facial nerve injury, Failed osteosynthesis,TMJpain

Inclusion Criteria:

1. Case series and Randomized controlled clinical trials (RCTs), either of a parallel group or of a split- mouth design.
2. Patients of age 18 - 81 years both sexes
3. Bilateral or unilateral condylar fractures
4. Condylar fractures with occlusal derangement
5. Condylar fractures with functional interference
6. Subcondylarfractures

3.1. Exclusion Criteria:

1. All the studies (ex-vivo, animal studies, review paper, case reports)
2. Studies with inadequate data on result.
3. Studies including closed reduction method of treatment.
4. Patients who have undergone previous surgery or trauma in the proposed surgical site.
5. Patients who have familial tendency to form hypertrophic scar
6. Patients with structural deficits of condyle
7. Patients with history of pathology in pericondylar region

4. Search For Identification of Studies

We searched the following electronic bibliographic databases: MEDLINE, Cochrane , web of science, Research Gate ,Scopus and Google Scholar database along with manual search in relevant peer review dental journals up to February 2022 using the searching keywords: (((((("outcome") OR ("effectiveness")) OR (result)) OR ("follow up")) AND ("Endoscopy"[Mesh])) AND ("Mandibular Condyle"[MeSH Major Topic])
Study Design: # (randomized trials) or (nonrandomized trials) or (controlled clinical trials) or (clinical trials).

Filters:

Language: Only English
Species: Only Human
Ages: young,middle aged, older
Journal categoriessearched : dental, head and neck surgery, otolaryngology, maxillofacial surgery, plastic surgery
Search dates: 1950–February 2022.

the MEDLINE search was used for use in searching the other databases. The search was supplemented by citation screening,hand searches, and scanning of all reference lists of selected papers.

5. Selection of Articles

Two review investigators (S.S & A.B) conducted the first screening independently by assessing the title and abstract of each article. The articles meeting the inclusion criteria were selected. In the second screening, full text articles were selected, taking into consideration the same inclusion criteria and a final list of articles were selected. In case of any difference in opinion, an open discussion was done and in case no consensus was made, help of a conciliator was taken to come to a decision. The selection and retrieving process is summarised down; summarizing that in total 423 articles were retrieved and in total 14 articles were scrutinised as final articles

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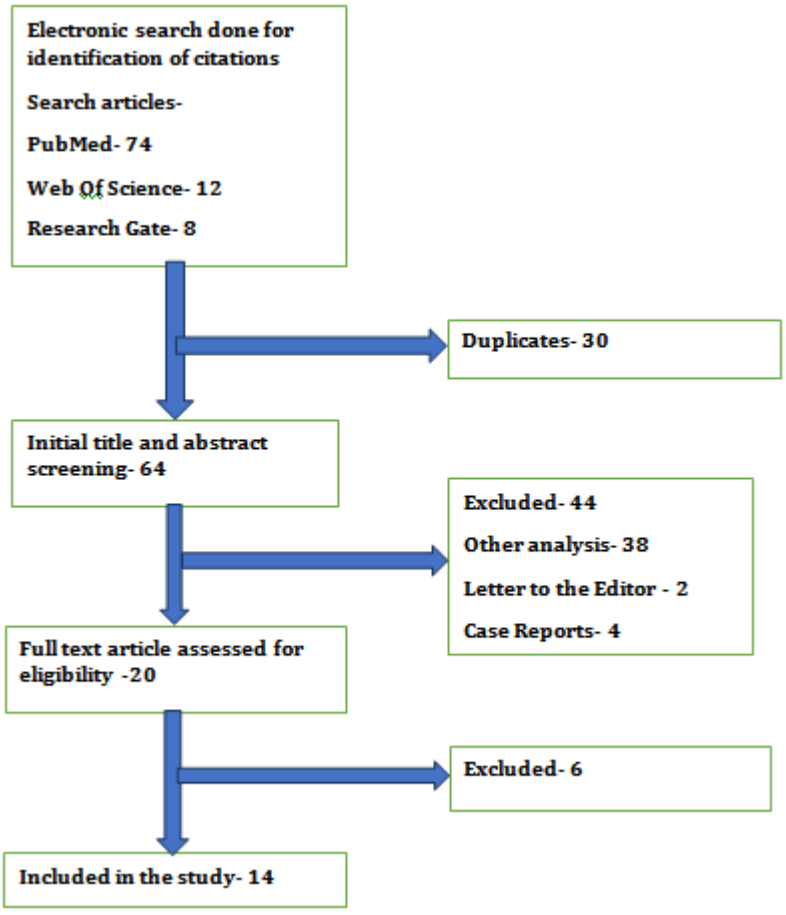

DATA EXTRACTION AND DATA ANALYSIS
Data extraction was done independently by the chief investigator onto an excel sheet (Windows 10), in two categories, demographic and quantitative data:

Data synthesis: Since the data extracted were heterogenous, qualitative synthesis of every research article was done.

Table No.1- Demographic Characteristics

Sl.	AUTHOR	YEAR	COUNTRY	STUDY DESIGN	NO OF CASES	SURGICAL APPROACH	TYPES OF #
1	Rafael	2007	GERMANY	CASE SERIES	25	TOEAORIF	CONDYLAR #
2	Francesco	2012	ITALY	CASE SERIES	12	TOEAORIF	SUBCONDYLAR #
3	Rainer	2009	SWITZERLAND	RCT	40	EAORIF	DISLOCATED UNI/BILATERAL CONDYLAR NECK #
4	R. Scho¨n	2002	GERMANY	CASE	17	EAORIF	CONDYLAR

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				SERIES			#
5	RALF	2003	GERMANY	CASE SERIES	8	EAORIF	CONDYLAR #
6	Osman	2017	TURKEY	CASE SERIES	15	TOEAORIF	SUBCONDYLAR #
7	Takahiro	2011	JAPAN	CASE SERIES	15	TOEAORIF	SUBCONDYLAR #
8	gunter	1999	USA	CASE SERIES	7	EAORIF	CONDYLAR #
9	venkatesh	2018	INDIA	RCT	32	EAORIF VS ORIF	CONDYLAR #
10	shinnosuke	2012	JAPAN	CASE SERIES	15	EAORIF VS ORIF	CONDYLAR #
11	sang hoon	2012	KOREA	CASE SERIES	26	EAORIF	CONDYLAR #
12	nahyun	2016	KOREA	CASE SERIES	30	TE VS SEI	CONDYLAR #
13	boaz	2020	ISRAEL	CASE SERIES	12	EAORIFEAORIF	SUBCONDYLAR #
14	mark C	2011	USA	CASE SERIES	4	EAORIF	SUBCONDYLAR #

Table No -2-Main characteristics of data from included studies

SL	AUTHOR	AETIOLOGY	AGE	No and TYPE OF #	CONCOMITANT #	SAMPLE SIZE	OPEN REDUCTION	ENDOSCOPIC	COMMENTS	FOLLOW UP TIME
1	Rafael	12 RTA,11violence ,2 Assault	33	24.diacapitular #,condylar neck #	6 left paramedian #,4 right paramedian #,2mandibular symphysis #,3mandibular angle #.	24		30-degree angle,4mm diameter endoscope,4-hole miniplates,monocortical screws	no joint clicking,no weakness of facial nerve,no joint pain	19.7 months
2	Francesco	7 Fall,2 RTA,2 Assault,1 sports injury	36.7	subcondylar #	NM	12		30-degree angle,4mm diameter endoscope,noncompession miniplates,MMF for 7 days	arterial hemorrhage,facial nerve injury,nonunion,partial condylar resorption	15 months
3	Rainer	NM	27 vs 26	dislocated uni/bilateral neck #	NM	74	34	40.transbuccal insertion of screws,noncompressible miniplates	facial nerve injury	12 months
4	R. Scho¨n	NM	26	condylar neck & subcondylar #	13.mandibular #	17		30degree angle 4mm diameter endoscope and xenon light	no TMJ disfunction,temporary weakness of mandibular branch of facial nerve	18months
5	RALF	NM	34	laterally &moderately dislocated #	6.mandibular #	16		30 dgree 4mm dm endoscope and xenon light	no facial nerve damage,no bony resorption,good TMJ function	17months
6	Osman	fall,assault,work accident	29.25	less than 45 degree medial deviation of subcondyle,lateral deviation of subcondyle	14.facial bone #	15		30 degree 4mm dm endoscope ,6-hole 2.0mm miniplate	minimal angulation in 3 patients,late TME pain	13months

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Sl.	AUTHOR	AETIOLOGY	AGE	No and TYPE OF #	CONCOMITANT #	SAMPLE SIZE	OPEN REDUCTION	ENDOSCOPIC	COMMENTS	FOLLOW UP TIME
7	Takahiro	NM	15-81	displaced linear subcondylar	NM	15		30 degree and 45 degree 4mm diameter endoscope ,two 2.0mm locking miniplate at posterior border of mandible and anterior buttress of condyle	good TMJ function,no clinical symptom	6month
8	Gunter	NM	NM					3.5mm endoscope with 2.0 miniplate	one plate removal	
9	Venkatesh	NM	26	unilateral condylar process #	NM	32	16	NM	altered mandibular deviation ,TMJ pain,TMJ clicking	6month
10	Shinnosuke	NM	27(16-47)	Neck & subcondylar #	nm	30	15	EAORIF ,2 miniplates	facial paresthesia	6months
11	Sang hoon	NM	NM	subcondylar #	NM	26		4mm dm straight endoscope with 30 degree optical tip.2mm miniplates	premature contact of teeth,slight open bite,TMJ pain.Surgical site infection	6months
12	Na hyun	NM	NM	condylar neck & subcondylar #	NM	15		4mm dm 30 degree endoscope with 6mm size titanium screws	facial nerve buccal branch palsy	12.7months
13	Boaz	fallRTA,Interpersonal violence	18-56	subcondylar #	NM	12		30 degree angle 4mm dm 10mm long transbuccal trocar	stable occlusion,No TMJ disfunction	6months
14	Mark C	NM	66-29	4,Subcondylar #	NM	4		4mm,30 degree endoscope with trocar	temporary facial nerve weakness in zygomatic and buccal branches	5months

Table No- 3- Outcomes of The Intervention

Sl.	Author	Occlusal Disturbances	Mean Incisal Opening	Deviation on opening	Protrusion	Laterotrusion Right	Laterotrusion Left	Nonunion	Condylar Resorption	Facial Nerve Injury	Failed Osteosynthesis	TMJ Pain	Operating Time
1	Rafael	no	48mm ±9mm	no	5.83 ±3mm	11mm ±3.8mm	10mm ±4.5mm		no	no	no	no	
2	Francesco	8.30%	39mm	–	–	–	–		8.30%	8.30 %	8.30%	8.30 %	112 min
3	Rainer	2 vs 6	38mm vs 31mm					1		5 vs 10			53.5 min vs 86.5min
4	R. Scho'n	2	40mm	no						2		no	170min
5	RALF		40mm	no		5 ±1mm	5 ±1mm	nonunion				no	
6	Osman		40mm									1	106 min
7	Takahiro		40mm	no								no	75min
8	Gunter												
9	Venkatesh	0 vs 16	43.63 ±7.5mm vs 42.53 ±7.4mm			0	0			1 vs 9		no	107 vs 155 m
10	Shinnosuke	0	43.4mm vs 44.7mm	0						0 vs 7		0	
11	Sang hoon	5								3		2	
12	Na hyun								9	1		5	128min
13	Boaz		45mm							no			180min
14	Mark C		35mm								1		

CHARACTERISTICS OF INCLUDED STUDIES

The search yielded 64 potential eligible articles after the exclusion of duplicate articles. Out of 64 articles, only 14 relevant articles were finalized which met the inclusion criteria. Among 14 articles,12are case series and 2 are RCTs .

11 case series and 1 RCT are performing TOEAORIF.1 case series AND 1 RCT have compared between EAORIF and ORIF.One study compared Submandibular endoscopic intraoral approach over standard transoral endoscopic approach.

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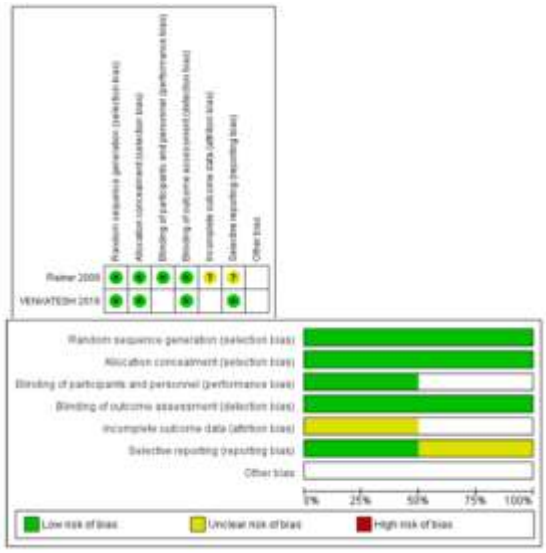
1. QUALITY ASSESMENT OF INCLUDED STUDIES

1.1. Risk of bias:

RoB analysis of the randomised studies were done using RevMan 5.3 software. In the study by Abdulhameed et al., the method of randomisation was not mentioned. Allocation concealment was not done in either of the studies. While one study was a double blinded study, the other one was a single blinded study. No other bias apart from the before mentioned lines were found.



Methodological quality and synthesis of case series by CARE protocol was considered to perform quality assessment of included studies. The domains were applied to evaluate the quality of selected case series are: Title, Key Words ,Abstract, introduction , patient information, Clinical Findings, Timeline Diagnostic Assessment, therapeutic intervention, follow up, outcome, discussion, patient consent . The level of quality was classified as: good when all the criteria were met, unclear when one criterion was absent and poor if two or more criteria were absent. Finally, all the included studies were evaluated by two independent reviewers (S.S. and A.B.). Disagreements regarding studies were resolved via discussion.

III. RESULT

Occlusal Disturbance-Francesco et al reported occlusal disturbances in 8.3% in EAORIF grp. R. Scho¨n et al reported in 2 cases, Sang hoon et al in 5 cases. In RCTs, Rainer et al. and Venkatesh.et al, reported occlusal disturbances which was more in the ORIF group as than EAORIF group.

Maximum Interincisal Opening- Except Francesco et al and Mark C et al all studies concluded maximal interincisalabove 40 mm opening after both of the treatment modalities. Rainer et al and Venkatesh et al showed more incisal opening in EAORIF than ORIF group.

Deviation On Opening – No deviation on opening was noticed in any studies both in EAORIF and ORIF group.

Protrusion- Rafael et al showed protrusion 5.83mm and other studies showed no significant reduction in mouth protrusion in either cases.

Lateraltrusion– Rafael et al and RALF et al mentioned Lateraltrusion. Rafael et al showed average is 11mm while Ralf showed average is 5mm.

TMJ Pain - Studies by Rainer et al ,Venatesh et al evaluated pain and concluded that it was more in case of EAORIF . Sang hoon et al and Na hyun et al showed TMJ pain in 2 and 5 cases respectively. Francesco et al showed in 8.3% cases TMJ pain.

Facial Nerve Weakness- Rainer et al showed facial nerve weakness in 5 EAORIF cases and 10 ORIF cases. Venkatesh et al mentioned one case in Endoscopic group vs 9 patients in ORIF group. Shinnosuke et al reported 7 patients in ORIF group. Sang hoon et al and Na hyun et al concluded in 3 and 1 patients respectively.

Operating Time–Intraoperative time is more in endoscopic management than open reduction internal fixation.

DISCUSSION

Condylar fracture management is one of the crucial decision in maxillofacial trauma. As it can affect both structural and functional unit of face.If not properly treated, it can lead to temporomandibular disorder, occlusaldisorders, ankylosis of TMJ,mandible deviation, and it may leadto severe impairment of the stomatognathic system. In open reduction there is a significance chance of injury to facial nerve.In endoscopic approach Rainer et al showed facial nerve weakness in 5 EAORIF cases and 10 ORIF cases. Venkatesh et al mentioned one case in Endoscopic group vs 9 patients in ORIF group. Shinnosuke et al reported 7 patients in ORIF group. Sang hoon et al and Na hyun et al concluded in 3 and 1 patients respectively. But operative time is more in endoscopic approach. Occlusal stability is achievable equally in both the cases. Interincisal distance was above 40mm in both cases.

IV. CONCLUSION

There is not any ideal approach for a certain fracture, but each patient needs to be fully evaluated according to that current situation both structurally and functionally. Moderate to severe

displacement with considerable ramus height shortening indicates the use of open reduction[1]. Endoscopic approaches are associated with considerable technical sensitiveness. But facial nerve weekness is considerably low in case of endoscopic approach. But further clinical trials are necessary particularly with endoscopic management of condylar fractures. Studies in the form of clinical trials ,systematic reviews, and observational studies are also required for the management of pediatric and geriatric condylar fractures[1].

Funding- Nil

Conflict Of Interest- None

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