Review Article

Is the facial nerve at risk following surgical correction of mandibular condylar fracture: A systematic review and meta-analysis

ABSTRACT

To review the literature on the effect of different surgical approaches on facial nerve injuries.The present systematic review addresses the following focus question:Is the facial nerve at risk following surgical correction of mandibular condylar fracture? Electronic and manual literature searches were conducted on databases:PubMed, ScienceDirect and Google scholar,Cochrane and clinicaltrials.gov for studies published until July 2020 to collect information about the effect of different surgical approaches on facial nerve injuries.Systematic literature review was performed following the prisma guidelines to identify studies. Quantitative retrospective and prospective studies,controlled trials,controlled clinical trials were included;case reports and review articles were excluded from this systematic review. 1500 articles published till July 2020 was identified. 116 articles met inclusion criteria. After applying exclusion criteria seven articles were shortlisted.The level of heterogeneity was observed to be less than 50%, between all parameters for all studies making publication bias to be minimum.On comparing various studies statistically using Z-test for all parameters,it was observed that level of significance was significant for various findings like Displacement/ Dislocation of fracture and transient facial nerve weakness was found to be statistically significant between all studies (p-value <0.05). Odd ratio, relative ratio and 95% CI was derived for all parameters recorded for various studies. Due to less number of subjective studies, and variability in study designs and lack of reporting on confounding factors,definitive conclusions on effect of various surgical approaches on facial nerve injury cannot be drawn Future well-designed long-term randomized controlled trials are necessary to reveal the necessary correlation between both the parameters.

Keywords: Condyle, database, fracture, incision, surgery

INTRODUCTION

The most prominent facial bone is the mandible that constitutes around 12%–56% of all facial fractures. Out of all mandibular fractures, condylar fractures account for about 29%–52%.[1] Various etiological factors of condylar fractures include interpersonal violence, fall injuries, and road traffic accidents. The result of condylar fractures is temporomandibular joint dysfunction, malocclusion, difficulty in chewing, and movement of the mandible.[2] The management of the condylar fracture is aimed at restoring maxillofacial symmetry and occlusion. This can be achieved either by the conservative (closed reduction + immobilization) or surgical (open reduction + internal fixation) approach.[3]

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Various surgical approaches have been documented with evidence of benefits for managing condylar and subcondylar fractures, i.e., submandibular, Transparotid, retromandibular, preauricular, rhytidectomy, and intraoral.[4] It has been observed in the literature that percutaneous approaches usually cause risk of facial nerve injury, reducing the quality of life.[5]

Various routes for dissection of cutaneous and subcutaneous layers shave been used for developing percutaneous approaches.[6] The procedures involving retromandibular incision are done via transparotid, retroparotid and transmasseteric anteroparotid approaches. All these approaches are based on the parotid gland.[7]

For submandibular incision, approaches like Risdon (traditional submandibular approach), high perimandibular, high cervical-Transmasseteric are used with a superficial dissection of the platysma.[8] With some approaches, potential damage to the facial nerve and its branches have been observed that drastically affect the type of surgical approach to be chosen. Various studies on facial nerve injuries identified various risk factors that include fracture site, the pattern of injury, and surgeon's experience.[9]

We undertook a systematic review of various published studies for evaluating the effect of various approaches used for the management of condylar fractures and analyzing the incidence of facial nerve injury in the form of transient or permanent facial nerve weakness and incidence of encountered facial nerve branches.

METHODS

The present systematic review was conducted using PRISMA guidelines, addressing the following focus question: Is the facial nerve at risk following surgical correction of mandibular condylar fracture? Electronic and manual data resources were evaluated using databases: PubMed, Science Direct and Google Scholar, Cochrane and clinicaltrials.gov for studies published from September 1999 to July 2020.

The results were limited to studies written in English. The search methodology applied was the combination of MeSH terms and keywords and displacement and/or dislocation of fractures, incidence of encountered seventh cranial nerve branches, kind of condylar fractures, like the type of approach, nerve branch (es) involved, permanent facial nerve weakness, transient seventh cranial nerve weakness.

Literature search on PubMed/MEDLINE was based on terms: (["facial nerve" (MeSH Terms) OR ["facial" (All Fields) AND "nerve"(All Fields)] OR "facial nerve" (All Fields) OR ["seventh" (All Fields) AND "cranial" (All Fields) AND "nerve" (All Fields)] OR "seventh cranial nerve" (All Fields)] AND branches (All Fields) AND ("transients and migrants" [MeSH Terms] OR ("transients"[All Fields] AND "migrants"[All Fields]) OR "transients and migrants"[All Fields] OR "transient"[All Fields]) AND ("facial nerve"[MeSH Terms] OR ("facial"[All Fields] AND "nerve"[All Fields]) OR "facial nerve"[All Fields] OR ("seventh"[All Fields] AND "cranial"[All Fields] AND "nerve"[All Fields]) OR "seventh cranial nerve"[All Fields]) AND ("frailty"[MeSH Terms] OR "frailty"[All Fields] OR "weakness"[All Fields]) AND permanent[All Fields] AND ("facial nerve"[MeSH Terms] OR ("facial"[All Fields] AND "nerve"[All Fields]) OR "facial nerve"[All Fields] OR ("facial"[All Fields] AND "nerve"[All Fields]) OR "facial nerve"[All Fields]) AND OR "weakness"[All Fields]) AND nerve[All Fields] AND branch[All Fields]) AND ("ethics"[Subheading] OR "ethics"[All Fields] OR "es"[All Fields]) AND (involved[All Fields] AND kind[All Fields] AND condylar[All Fields] AND ("fractures, bone"[MeSH Terms] OR ("fractures"[All Fields] AND "bone"[All Fields]) OR "bone fractures"[All Fields] OR "fractures"[All Fields]) AND OR (("joint dislocations"[MeSH Terms] OR ("joint"[All Fields] AND "dislocations"[All Fields]) OR "joint dislocations"[All Fields] OR "dislocation"[All Fields]) AND ("fractures, bone"[MeSH Terms] OR ("fractures" [All Fields] AND "bone"[All Fields]) OR "bone fractures" (All Fields) OR "fractures" (All Fields)]). Around 258 relevant publications were found.

The following terms were used in the search strategy on the Cochrane Library, the database for systematic review: Type of approach, the incidence of encountered seventh cranial nerve branches, transient seventh cranial nerve weakness, permanent facial nerve weakness, nerve branch (es) involved, kind of condylar fractures, and displacement and/or dislocation of fractures.

We found the following data: Cochrane Reviews-0, Cochrane Protocols-0, Trials-0, Editorials-0, Special collections-0, Clinical Answers-0, and Other Reviews-0. The literature search on Embase reflected 228 relevant publications by using the same keywords.

Inclusion and exclusion criteria

Adult patients who underwent ORIF using various surgical approaches to expose, reduce and stabilize Condylar fractures within which the amount of encountered seventh cranial nerve branches were reported. Studies showing relationship and correlation between the incidence of facial injury and the number of encountered facial nerve branches during surgery. Clinical human studies, including randomized controlled trials, controlled clinical trials, prospective and retrospective studies that adequately reported the number of encountered facial nerve branches during surgery and instances of

transient and/or permanent facial nerve weakness for various surgical approaches within the surgical operation of condylar fractures were included.

The following exclusion criteria were applied: (1) Patients with preoperative facial paralysis, (2) studies that did not explicitly report details about surgical incisions and dissection, (3) studies that failed to report clearly the quantity of patients with cranial nerve paralysis, (4) review articles, (5) animal or *in vitro* studies, (6) Previous scar present in temporalis region, (7) case reports.

Study selection

Two reviewers screened all identified titles and abstracts independently. In addition, the reference lists of the subsequently selected abstracts and the bibliographies of the selected studies were searched manually. For studies appearing to meet the inclusion criteria, or for which insufficient data in the title and abstract was available, the full text was obtained. Disagreements were solved through discussion between the reviewers. Finally, the full-text evaluation of the remaining publications was done using the above-listed inclusion and exclusion criteria.

Data extraction

Two reviewers independently extracted data from the included studies. Disagreements were again resolved through discussion. Corresponding authors were contacted when data were incomplete or unclear. With respect to the listed question of our systematic review, data were sought for predictor variables, i.e., type of approach, the incidence of encountered facial nerve branches, transient facial nerve weakness, permanent facial nerve weakness, nerve branches involved, type of condylar fracture, and displacement/dislocation of fracture. Finally, the funding sources of the selected studies have been checked.

Quality of the studies

Quality assessment of the selected studies was executed by the Newcastle–Ottawa scale. Scale was applied for cohort studies to judge each included study on selection of studies, comparability of cohorts, and the ascertainment of either the exposure or outcome of interest. Stars were awarded such that the highest quality studies were awarded up to nine stars.

Statistical analysis

Statistical software RevMan (Review Manager [Computer program], version 5.3, Copenhagen: The Nordic Cochrane Centre, The Cochrane Collaboration, 2014) was used for statistical analysis. Differences in means and risk ratios were used as principal summary measures. The overall estimated effect was categorized as significant where $P < 0.05$.

RESULTS

One thousand and five hundred articles published until July 2020 were identified. 116 articles met inclusion criteria. After applying exclusion criteria20 articles were shortlisted. The initial electronic database search on PubMed/MEDLINE, Embase and Cochrane Library resulted in 1500 titles. After screening the abstracts, 116 relevant titles were selected by two independent reviewers and 1384 were excluded for not being related to the topic. Following examination and discussion by the reviewers, 116 articles were selected for full-text evaluation. Hand searching of the reference lists of the selected studies did not deliver additional papers.

After prescreening, application of the inclusion and exclusion criteria and handling of the question of our systematic review, 20 studies remained. They were used for data extraction and statistical analysis.

Study characteristics

Demographic data

Within the remaining group of 20 included studies, seven were retrospective and thirteen were prospective cohort studies using data from patients who underwent management of condylar fractures using any of the approaches; retromandibular transparotid, retromandibular anteroparotid transmasseteric, high mandibular subparotid, supratemporalis, or preauricular approach that can cause facial nerve injury.

In all studies, we observed that patients who underwent management of condylar fractures ranged between 13 and 87 years, with a mean age of 34.45 years. A total of 1114 patients were evaluated in all 20 studies with 425 males and 121 females were included according to inclusion criteria. For condylar fracture management various approaches were used in different studies. The most common approach observed was retromandibular and the least common was Trans-masseteric antero-parotid [Table 1].

Results of the individual studies

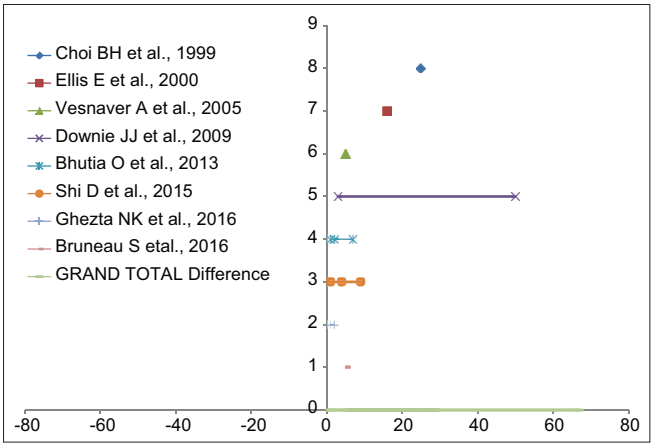
As measured in the 20 included studies containing 546 patients with condylar fractures being treated using different approaches. Incidence of encountered facial nerve branches was observed. It was found that in studies by Ellis *et al*., 2000;[5] Bhutia *et al*., 2013;[10] Shi *et al*., 2015;[9] Ghezta *et al*., 2016;[11] Bruneau *et al*., 2018[12] marginal mandibular nerve palsies were involved in around 13 cases. In 74 cases, the buccal nerve was involved, as found in studies by Ellis *et al*., 2000;[5] Downie *et al*., 2009;[13] Bhutia *et al*., 2013;[10] Shi *et al*., 2015;[9] Ghezta *et al*., 2016.[11] Few studies showed the involvement of greater auricular, zygomatic, and temporal nerves [Graph 1]. We also observed the incidence of temporary and permanent

Table 1: Demographic table

Author (reference number)	Country	Study design	Number of cases	Age (years)	Male: female	Type of approach
Choi and Yoo, 1999[22]	South Korea	Prospective	25	20-71 (31)	5:2	Preauricular
Ellis *et al*., 2000[10]	Texas	Prospective	93	16-70	76:17	Retromandibular
Vesnaver *et al*., 2005[18]	Slovenia	Prospective	36	14-64	21:13	Transparotid
Downie *et al*., 2009[14]	Glasgow	Prospective	50	-	-	Transparotid
Narayanan *et al*., 2009[23]	India	Prospective	35	-	-	Retromandibular
Bindra *et al*., 2010[19]	India	Prospective	10	19-56 (31.6)	-	Retromandibular
Girotto *et al*., 2012[25]	Italy	Prospective	19	17-65 (35.4)	23:2	Retromandibular transparotid approach
Yabe *et al*., 2013[15]	Japan	Prospective	15	16-49 (28.6)	5:2	Preauricular transparotid approach
Bhutia *et al*., 2014[10]	India	Prospective	44	18-56	-	Retromandibular transparotid
Bouchard and Perreault, 2014[16]	Canada	Retrospective	118	13-82 (35.6)	81 males	Retromandibular
Shi *et al*., 2015[9]	China India	Retrospective	102	27.5	61:29	Retromandibular transparotid
Ghezta *et al*., 2016[12]	India	Prospective	47	18 to 45 (28.5)	12:1	Retromandibular transparotid approach
Kanno *et al*., 2016[20]	Japan	Retrospective	55	17-87 (44.5)	7:3	Retromandibular transparotid
Li *et al*., 2016[17]	China	Prospective	84	4-70 (29.85)	2:1	Preauricular supratemporalis
Bruneau *et al*., 2018[12]	Geneva	Retrospective	48	17-84 (41.5)	37:6	Retromandibular subparotid
Yoon *et al*., 2019[25]	Korea	Retrospective	58	18-67 (43.5)	43:15	Preauricular transparotid approach
Imai *et al*., 2019[7]	Japan	Retrospective cohort	114	47.1	10:7	Submandibular and retroparotid approaches
Imai *et al*., 2019[7]	Japan	retrospective	87	40.3	6:5	Submandibular and retroparotid approaches; transparotid, transmasseteric anteroparotid; cervical-TMAP
Machoň *et al*., 2019[24]	Czech Republic	Prospective	44	18-73 (39.5)	22:17	Trans-masseteric antero-parotid
Parihar *et al*., 2019[21]	India	Prospective	30	33.93 (17.97)	14:1	Retromandibular transparotid approach versus retromandibular transmasseteric anterior parotid

TMAP: Transmasseteric anteroparotid

facial weakness. In 170 cases out of 546, temporary facial weakness was observed in all studies except Yabe *et al*., 2013[14] [Graph 2], whereas only 5 cases showed permanent facial weakness in studies by Bouchard *et al*., 2014;[15] Li *et al*., 2016;[16] Imai *et al*., 2019[7] [Graph 3]. In many studies, we found that common fractures observed were subcondylar and condylar neck fractures. We observed the incidence of displacement or dislocation of condylar fracture. 488 cases showed displacement and 211 cases showed dislocation. Studies by Vesnaver *et al*.,[17] 2005; Bindra *et al*., 2010;[18] Bhutia *et al*., 2013;[10] Shi *et al*., 2015;[9] Ghezta *et al*., 2016;[11] Kanno *et al*., 2016;[19] Bruneau *et al*.,[12] 2016 and Parihar *et al*., 2019[20] showed both displacement and dislocation of condylar fractures. All other studies[5,16,21-23] showed only displacement of the condyle, whereas Imai *et al*., 2019;[7] Imai *et al*., 2020[26] showed isolated condyle dislocation [Graph 4 and Table 2].



Graph 1: Incidence of encountered facial nerve branches

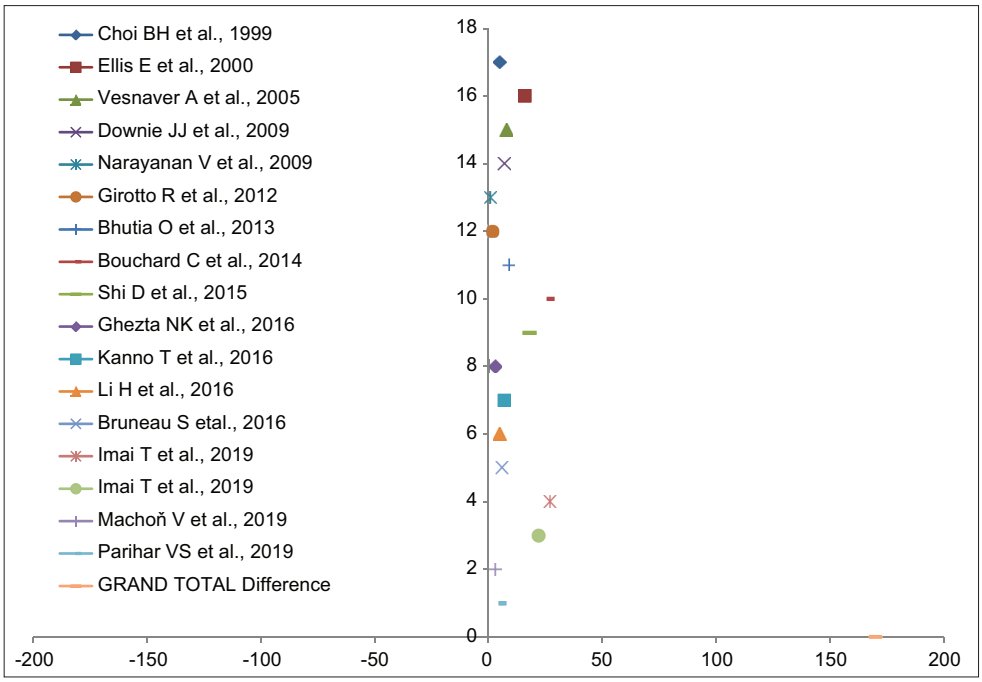
Quality of the studies

Quality assessment of the included quantitative cohort studies was executed according to the Newcastle-Ottawa scale. The 20 studies were of moderate quality, and the risk of bias was analyzed. The scale was applied for cohort studies to judge each included study on selection of studies, comparability of cohorts, and the ascertainment of either the exposure or outcome of interest. Stars were awarded such that the highest quality studies were awarded up to nine stars.

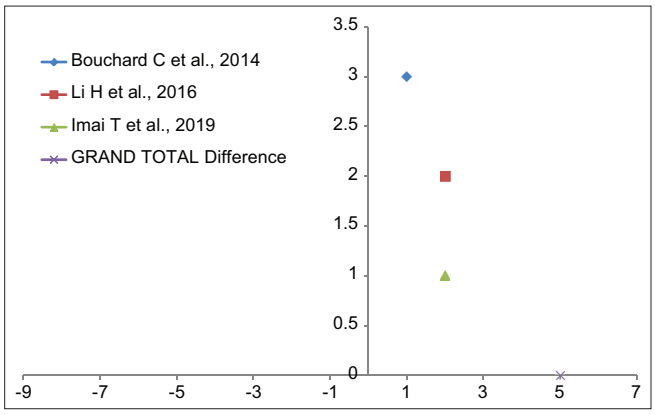
Synthesis of results

Main results of meta-analysis

Results of all the studies were compared in relation to various parameters observed Incidence of encountered facial nerve branches, transient facial nerve weakness,



Graph 2: Transient facial nerve weakness



Graph 3: Permanent facial nerve weakness

permanent facial nerve weakness, and displacement/dislocation of fracture. The heterogeneity test was conducted using Chi-square test, for all the parameter comparisons. It has been observed that all parameters showed the insignificant level of significance ($P > 0.05$) between all studies, except displacement/dislocation of fracture. The level of heterogeneity was observed to be <50%, between all parameters for all studies making publication bias to be minimum.

On comparing various studies statistically using Z-test for all parameters, it was observed that level of significance was significant for displacement/dislocation of fracture and transient facial nerve weakness between all studies ($P < 0.05$). Odds ratio, relative ratio, and 95% confidence interval were derived for all parameters recorded for various studies [Table 3].

DISCUSSION

This meta-analysis and systematic review assessed the effect of the surgical approach on facial nerve injuries. This analysis revealed that evaluation of appropriate surgical approach could be used as an important tool to determine the chance of getting facial nerve injury, taking its relevant role into consideration for surgical management of condylar fractures.

We observed that when the retromandibular approach was used in studies, transient facial nerve weakness was detected in almost all cases. Even in a few cases, studies showed the incidence of permanent nerve damage too. The incidence of transient damage to branches of the facial nerve has been reported to be between 12% and 48% when the retromandibular transparotid approaches were used.[5,13] This can be attributed to the fact that surgical access is attained between the branches of the parotid gland.

The other commonly used approach was preauricular incision. This approach can be used to avoid retraction and is not even in the area of branches of the facial nerve. But with the preauricular approach, the reduction of low subcondylar fractures is difficult to achieve. This approach is applicable and for high condylar fractures, as incision is given too high in this region. The incidence of facial nerve damage with pre-auricular approach has been reported to be 3%–48%.[27,28] The submandibular approach can also be used for the management of condylar fractures, but the disadvantage of this approach is that it gives a large incision with limited

Table 2: Main characteristics of data from included studies

Author (reference number)	Type of approach	Incidence of encountered facial nerve branches	Transient facial nerve weakness	Permanent facial nerve weakness	Nerve branches involved	Type of condylar fracture	Displacement/ dislocation of fracture
Choi and Yoo, 1999[22]	Preauricular	25	*n*=5	0	Zygomatic, buccal	High condylar neck fractures	25
Ellis *et al*., 2000[10]	Retromandibular	Marginal mandibular branch: 17.2%	16	0	Buccal, marginal mandibular branch	Head, neck, subcodylar	26
Vesnaver *et al*., 2005[18]	Transparotid	Greater auricular nerve - 5 cases	8	0	Zygomatic, buccal or both	Condylar neck, subcondylar	36 - Displaced 14 - Dislocated
Downie *et al*., 2009[14]	Transparotid	Zygomatic - 3 Buccal - 50	7	0	Zygomatic, buccal	Condylar fractures	-
Narayanan *et al*., 2009[23]	Retromandibular	-	1	0	-	Head, neck, subcodylar	35 - Displaced
Bindra *et al*., 2010[19]	Retromandibular	-	0	0	-	Condylar, subcondylar	5 - Displaced 6 - Dislocated
Girotto *et al*., 2012[25]	Retromandibular transparotid approach	-	2	-	-	Intracapsular, high subcondylar, condylar base	-
Yabe *et al*., 2013[15]	Preauricular transparotid approach	-	0	0	-	Condylar neck, subcondylar	-
Bhutia *et al*., 2014[10]	Retromandibular transparotid	Buccal (*n*=7), marginal mandibular (*n*=2), and zygomatic (*n*=1)	9	0	Buccal, marginal mandibular, zygomatic	Subcondylar fracture	7 - Displaced 23 - Dislocated
Bouchard and Perreault, 2014[16]	Retromandibular	-	26	1	-	Condylar subcondylar	-
Shi *et al*., 2015[9]	Retromandibular transparotid	Temporal - 1 Zygomatic - 4 Buccal - 9 Marginal mandibular - 4 Cervical - 0	18	0	Temporal, zygomatic, buccal, marginal mandibular, cervical	Condylar neck, subcondylar	102 - Displaced 102 - Dislocated
Ghezta *et al*., 2016[12]	Retromandibular transparotid	Marginal mandibular branch - 2 Buccal - 1	3	0	Marginal mandibular, buccal branch	Condylar neck, subcondylar	39 - Displaced 5 - Dislocated
Kanno *et al*., 2016[20]	Retromandibular transparotid	-	7	0	-	Subcondylar	23 - Displaced 21 - Dislocated
Li *et al*., 2016[17]	Preauricular supratemporalis	-	Preauricular - 5 Supratemporalis - 0	Preauricular - 2 Supratemporalis - 0	-	Intracapsular condylar	84 - Displaced
Bruneau *et al*., 2018[12]	Retromandibular subparotid	Marginal mandibular branch - 5	6	0	Marginal mandibular branch	Subcondylar	34 - Displaced 12 - Dislocated
Yoon *et al*., 2019[25]	Preauricular transparotid approach	-	-	-	Frontal zygomatic branches	Condylar head, neck	-
Imai *et al*., 2019[7]	Submandibular and retroparotid approaches	-	27	-	Marginal mandibular branch	Condylar neck, subcondylar	15 - Dislocated
Imai *et al*., 2020[27]	Submandibular and retroparotid approaches; transparotid, transmasseteric anteroparotid; cervical-TMAP	-	22	2	-	Condylar neck, subcondylar	13 - Dislocated
Machoň *et al*., 2019[24]	Trans-masseteric antero-parotid	-	3	0	-	Sub-condylar	43 - Displaced

Contd...

Table 2: Contd...

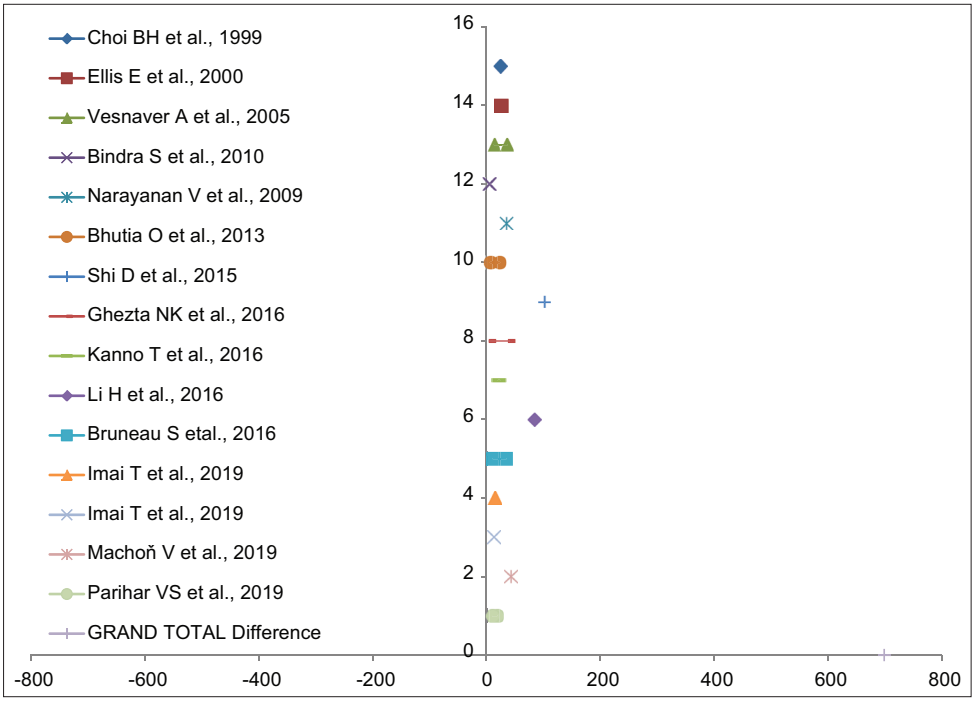
Author (reference number)	Type of approach	Incidence of encountered facial nerve branches	Transient facial nerve weakness	Permanent facial nerve weakness	Nerve branches involved	Type of condylar fracture	Displacement/ dislocation of fracture
Parihar *et al.*, 2019[21]	Retromandibular transparotid approach versus retromandibular transmasseteric anterior parotid	-	5	0	-	Condylar neck and base	18 - Displaced 11 - Dislocated

TMAP: Transmasseteric anteroparotid

Table 3: Metanalysis showing comparison between all study groups for various parameters

Results	Heterogeneity test				OR	RR	95% CI	Overall test	
	χ^2	df	*P*	I^2 (%)				*Z*	*P*
Incidence of encountered facial nerve branches	3.819	8	0.223	42	1.52	1.36	0.660-0.979	2.812	0.199
Transient facial nerve weakness	1.89	4	0.342	41	3.25	2.45	0.45-0.72	0.920	0.026*
Permanent facial nerve weakness	2.773	1	0.157	45	34.56	24.35	63.48-85.18	0.971	0.982
Displacement/dislocation of fracture	0.15	1	0.013*	41	1.35	2.67	0.412-0.736	2.99	0.003*

*$P<0.05$ is significant. I^2 was obtained<50% in all the parameters, suggesting the absence of heterogeneity. OR: Odds ratio, RR: Relative risk, CI: Confidence interval



Graph 4: Displacement/dislocation of fracture

access to the condylar fragments, thus compromising the quality of fracture reduction and fixation. The incidence of facial nerve damage was reported to be around 5%–48%.[28]

The use of other techniques like transmasseteric anteroparotid technique was found to reduce the incidence of salivary fistulation and facial nerve damage. The transparotid approach involves the blunt dissection of the parotid capsule and parenchyma of the parotid that can increase the chances of parotid fistulas and can lead to transient facial nerve damage.[29]

The retromandibular transparotid approach is the only incision that is placed in close vicinity to the fracture line, providing direct access to the fractured area. The facial nerve divides into the temporofacial branch (comprised of temporal and zygomatic branches) and the cervico-facial branch (cervical, buccal, marginal mandibular branches). The area of dissection lies between the buccal and marginal mandibular branches.[29] The superior margin of the incision is retracted more for plating and to locate the medial overlapping condyle. This can cause an increased incidence of neuropraxia in the buccal branch. Similar findings we also observed in our

meta-analysis and systematic review, showing transient facial nerve weakness and damage to the buccal branch.

The retraction can lead to transient neuropraxia resulting in facial palsy. The sites having dislocated condylar fragments can lead to more transient nerve palsies than the ones with lateral overlap.[10] It has been observed that the occurrence of facial nerve dysfunction is usually transitory and resolves within 6 months.

As only few studies reported the incidence of permanent facial paralysis, thus the exact incidence is unknown. The reason of facial nerve injuries is either by dissection of the facial nerve or due to blunt dissection through the parotid gland and masseter muscle.[21] This occurs in open reduction of condylar fractures with various incisional approaches.We observed that various studies reported damage to various branches of the facial nerve. The zygomatic, buccal, and marginal branches were commonly dissected out and protected after the main trunk of the facial nerve was exposed.[21]

In a study by Raveh *et al*.,[30] it has been advocated that facial nerve damage is primarily caused by excessive traction by the use of retractors or by electro-cauterization of the vessels adjacent to the facial nerve. The key to prevent facial nerve damage lies in the fact that surgical approach should be such, through which the facial nerve could easily be identified and preserved.

To prevent facial injuries, the surgical approach should provide the most direct access to the dislocated and displaced fractured fragments; excessive traction by the retractors should be avoided. As the surgical procedure is technique sensitive, thus it has been proposed in studies that management of condylar fractures should only be attempted by experienced surgeons who are well-known with superficial parotidectomy.

The current systematic review studied the literature on the various recorded parameters [Diagram 1]. The 20 included papers comprised both prospective and retrospective cohort studies. All the studies were analyzed separately. As demonstrated by equality of the risk ratios and on account of the limited amount of included studies, the relevance of obtained information needs to be verified further. Bias is not present in the included papers.

Limitations of meta-analysis

The present systematic review analyzes only a few incisional

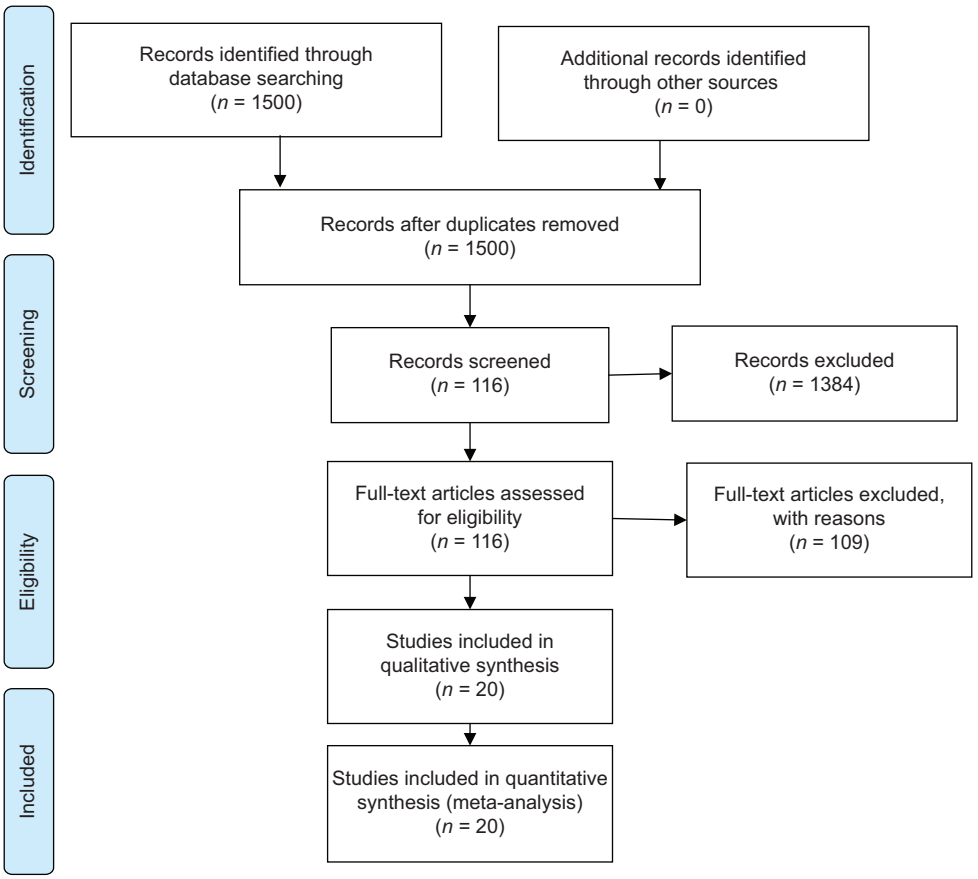


Diagram 1: PRISMA flow diagram

approaches for condylar fracture management. Further studies should be conducted assessing and comparing the role of other approaches.

1. More systematic reviews should be conducted taking other incisional approaches into consideration
2. We have only considered quantitative studies. Future systematic reviews should be conducted using any type of published literature
3. We have considered limited database search, thus database search can be widened, using more search engines and considering all published studies till date.

CONCLUSION

With all the literature research within the scope of our systematic review, the conclusion drawn that accurate reduction and rigid fixation of high condylar neck fractures were possible through the use of an approach in which the facial nerve was exposed without any permanent damage of the facial and great auricular nerves. The complications seen will probably be avoidable as our experience increases. Due to lack of data for a few parameters in many studies, variability in study parameters and less number of reported studies, definitive conclusions of the effect of various incisional approaches on facial nerve damage need to be verified with more literature search. More number of observational studies and well-designed long-term randomized controlled trials are needed.

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Conflicts of interest

There are no conflicts of interest.

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