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Extracapsular dissection versus partial superficial parotidectomy for the treatment of benign parotid tumours

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Abstract. The purpose of this study was to compare the complications of patients treated for a benign parotid tumour (BPT) by extracapsular dissection (ECD) vs. partial superficial parotidectomy (PSP). A comprehensive literature investigation was conducted by searching electronic databases. A systematic review and meta-analysis of comparative studies were performed to assess ECD and PSP for the treatment of BPTs with fixed-effects models. The outcomes analysed were transient or permanent facial nerve injury, Frey syndrome, recurrence rate, infection, and salivary fistula/sialocele. A total of 1641 patients from seven studies (1120 ECD-treated and 521 PSP-treated patients) were included in this meta-analysis. Transient facial nerve injury (odds ratio (OR) = 0.28, 95% confidence interval (CI): 0.11–0.71; $p = 0.008$) and Frey syndrome (OR = 0.12, 95% CI: 0.03–0.48; $p = 0.003$) were less prevalent in the ECD group. The rates of permanent facial nerve injury (OR = 0.77, 95% CI: 0.35–1.70; $p = 0.520$), recurrence rate (OR = 0.17, 95% CI: 0.02–1.75; $p = 0.14$), infection (OR = 0.70, 95% CI: 0.07–6.67; $p = 0.76$), and salivary fistula/sialocele (OR = 0.40, 95% CI: 0.06–2.66; $p = 0.350$) were similar in both groups. Although there was a trend that ECD showed a reduced risk for complications, the present results are not sufficient to conclude that ECD is more beneficial than PSP.

Key words: parotid benign tumour; extracapsular dissection; partial superficial parotidectomy.

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Parotid tumours account for approximately 3% of head and neck neoplasms, of which 70–80% are benign[1–3]. Surgeons are cautious about excising benign parotid tumours (BPTs), especially those found in the superficial lobe area, because of the high risk of postoperative complications. The major operational options for BPTs are extracapsular dissection (ECD), partial superficial parotidectomy (PSP), superficial parotidectomy (SP), and total parotidectomy[4]. In recent years, the most common surgery performed has shifted from SP to PSP[5,6]. Several studies have suggested that ECD may be a better choice for dealing with BPTs[7–10].

The relative advantages of ECD and PSP remain controversial. Although the

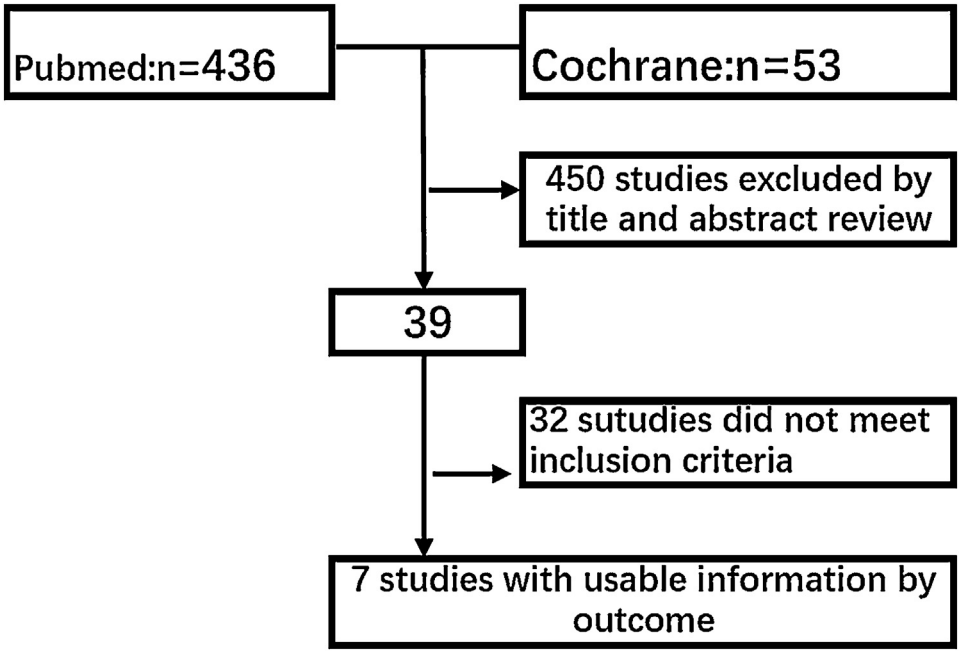

Fig. 1. Flow diagram of studies identified, included and excluded.

superiority of PSP for the treatment of BPTs has been debated, only one study has reported differences between ECD and PSP. Witt and Rejto[11] compared these two surgical approaches and found that ECD had significantly higher rates of recurrent pleomorphic adenoma and permanent facial nerve dysfunction as well as a lower rate of transient facial nerve dysfunction. Despite these findings, the authors did not draw conclusions about which procedure was optimal for the treatment of BPTs. Based on our clinical observations, we hypothesized that ECD may achieve better outcomes than PSP for the treatment of BPTs. Still, concerns related to postoperative complications, including recurrence rate, facial nerve injury, Frey syndrome, aesthetics, infection, salivary fistula, and sialocele, also factor into procedure selection. To the best of our knowledge, no previous clinical study has examined the relative safety and efficacy of ECD, and PSP has remained the standard treatment for resection of BPTs.

The purpose of this study was to conduct a meta-analysis to assess the clinical efficacies of ECD and PSP for the treatment of BPTs located in the superficial lobe area. Patients treated with ECD or PSP were compared in terms of their risks for postoperative transient or permanent facial nerve injury, Frey syndrome, recurrence, infection, salivary fistula, and sialocele. Aesthetic outcomes were also considered.

Materials and methods

Search strategy

The PubMed and Cochrane Library databases were searched systematically, without restriction, for articles published before September 2018. Studies comparing ECD with PSP in patients with BPTs were retrieved with the following search terms: ''extracapsular dissection'', ''partial superficial parotidectomy'', ''parotid resection'', ''parotid tumors'', ''parotid benign tumors'', and ''parotid neoplasm''. The related-articles function was used to broaden the search. All of the retrieved abstracts, studies and citations were reviewed, irrespective of publication language.

When multiple reports describing the same population were published, only the most recent or complete report was used. Searches were conducted independently by two authors. This meta-analysis was carried out and reported in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-analysis checklist[12].

Inclusion and exclusion criteria

Studies comparing ECD and PSP in patients undergoing surgery for BPTs with an accurate description of the surgical technique and reporting at least one quan-

Table 1. Characteristics of included studies.

Studies	Year	Type	Patients (ECD/PSP)	Gender (M/F)	Age	Tumour size	Follow-up	Outcomes	Quality
Witt	2012	R	8/4	ND	ND	NL	ND	1.2.3.5.6	4 stars
Zheng	2018	R	92/91	98/85	19–83 years old	1.8–3.4 cm	28 months (mean)	1.2.3.4.5.6	8 stars
Mantsopoulos	2015	R	796/217	ND	ND	NL	ND	2	4 stars
Iro	2013	R	187/43	184/137	ND	ND	88.5 months (mean)	4	5 stars
Ciuman	2012	R	20/95	ND	ND	ND	At least 12 months	1.2.3	5 stars
Park	2018	R	12/15	12/15	50 years old	1–7 cm	12 months (means)	2.3	4 stars
Wong	2017	P	5/56	ND	18–86 years old	ND	7.4 months (mean)	1.2.3.5.6	5 stars

ECD, extracapsular dissection; ND, no description; NL, no limitation; P, prospective study; PSP, partial superficial parotidectomy; R, retrospective study. Outcomes: 1 = transient facial nerve injury; 2 = permanent facial nerve injury; 3 = Frey syndrome; 4 = recurrence; 5 = infection; 6 = salivary fistula or sialocele.

titative outcome measure were included. The exclusion criteria were parotid malignancy, case reports/review articles, and lack of a stated follow-up period.

Data extraction

Data were extracted independently by two investigators, and disagreement was resolved by discussion. For each study, the following information was extracted: first author, year of publication, study design, inclusion and exclusion criteria, number of patients who underwent each type of procedure, follow-up period and outcomes. Any facial weakness or paralysis after ECD or PSP was attributed to facial nerve injury. Frey syndrome was defined as localized sweating in the area adjacent to the surgical site in response to gustation. Recurrence referred to detection of regrowth of the same tumour at follow-up. Signs of infection included redness, swelling, warmth, and pain in the area adjacent to the surgical wound as well as fever and/or purulent discharge. Saliva in the surgical site was taken as a sign of a salivary fistula. Sialocele was diagnosed if salivary or serous fluid continued to collect in the parotid bed for at least 2 weeks.

Quality assessment

Study quality was assessed with the Newcastle–Ottawa Scale, which considers three factors: methods used for patient selection, comparability of study groups, and number of outcomes reported. Each study was rated on a scale from 0 to 9[13].

Statistical analysis

All analyses were performed with Review Manager, version 5.2, and STATA SE, version 12.0, software for StataCorp. Odds ratios (ORs) were used to compare dichotomous variables. These were reported with 95% confidence intervals (CIs). An OR <1 favoured the ECD group. The point estimate of the OR was considered to be statistically significant at $p < 0.05$ if the 95% CI did not include the value 1[14].

Inter-group heterogeneity was assessed with χ^2 and I^2 statistics, which are reported with degrees of freedom (*df*). The assumption of homogeneity between groups was invalidated if $p < 0.10$, in which case a random-effects model was used. In all other cases, a fixed-effects model was used. Begg's test and funnel plot analyses were used to detect publication bias. A two-tailed $p < 0.05$ was considered significant.

Results

Literature search and study characteristics

The process of evaluating articles for inclusion in this review and meta-analysis is summarized in Fig. 1. Briefly, electronic database searching identified 489 potentially relevant studies. After reviewing all of the abstracts, 39 studies were deemed to be germane and suitable with respect to the inclusion and exclusion criteria. After reading the full-text articles, seven studies[15–21] fulfilled the selection criteria and were included in this meta-analysis. A survey of the study references did not reveal any additional studies appropriate for inclusion. Descriptions of the included studies are provided in Table 1. The analysed studies included 1641 patients (1120 subjected to ECD and 521 subjected to PSP). The rates of agreement between reviewers were 95% for study selection and 92% for assessment of trial quality. Any discrepancy of opinion was resolved by discussion.

No randomized controlled or case–control trial was identified. All seven studies included were cohort studies (six retrospective, one prospective). The results and complications reported in the included studies are presented in Table 2. The quality of the included studies was generally low. None of the retrospective studies provided an appropriate protocol for treatment assignment, and the patients were allocated into the treatment groups by clinicians. In most studies included in this meta-analysis, the methods used for handling missing data and intention-to-treat analyses were not explicitly defined.

Facial nerve injury

The occurrence of transient facial nerve injury among 371 patients in four studies[15,16,20,21] was lower for ECD than for PSP (OR = 0.28, 95% CI: 0.11–0.71; $p = 0.008$; Fig. 2A), with no significant between-study heterogeneity ($\chi^2 = 0.80$, $df = 2$, $p = 0.670$; $I^2 = 0\%$). The permanent facial nerve injury group included 1411 patients from six studies[15,16,18–21]. Statistical analysis revealed no significant difference between ECD and PSP (OR = 0.77, 95% CI: 0.35–1.70; $p = 0.520$; Fig. 2B). In addition, no publication bias was detected (Begg's test, $p = 0.373$; Fig. 3).

Table 2. Results of meta-analysis comparison of extracapsular dissection (ECD) and partial superficial parotidectomy (PSP).

Outcomes	Studies, *n*	ECD patients, *n*	PSP patients, *n*	OR (95% CI)	*p**	Study heterogeneity			
						χ^2	*df*	I^2, %	p value*
Transient facial nerve injury	4	125	246	0.28 (0.11.0.71)	0.008	0.80	2	0	0.67
Permanent facial nerve injury	6	933	478	0.77 (0.35, 1.70)	0.52	0.82	4	0	0.94
Frey syndrome	5	137	261	0.12 (0.03, 0.48)	0.003	3.07	2	35	0.22
Recurrence	2	168	109	0.17 (0.02, 1.75)	0.14	0.39	1	0	0.53
Infection	3	105	151	0.70 (0.07, 6.67)	0.76	0.63	1	0	0.43
Salivary fistula or sialocele	5	105	151	0.40 (0.06, 2.66)	0.35	1.01	2	0	0.60

CI, confidence interval; *df*, degrees of freedom; OR, odds ratio.
* Statistically significant results are shown in bold.

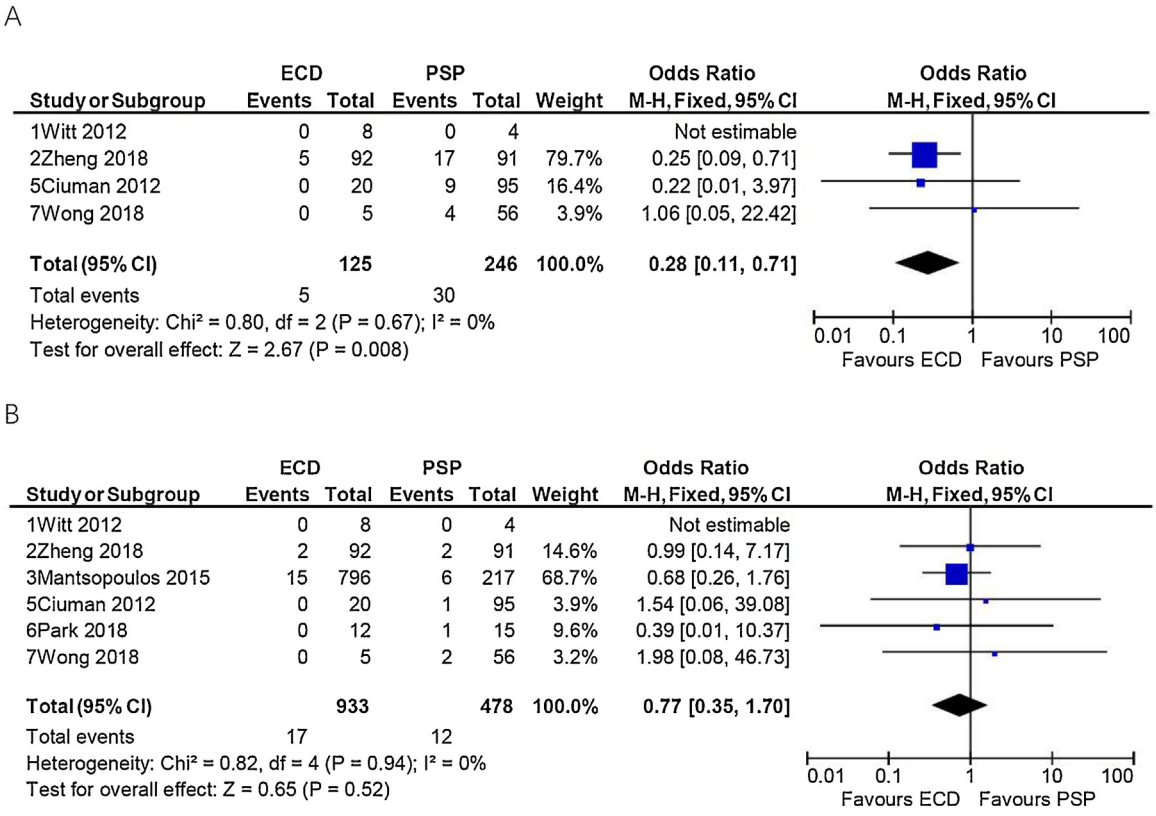

Fig. 2. Forest plot and meta-analysis of transient facial nerve injury (A) and permanent facial nerve injury (B).

Frey syndrome

Analysis of data pooled from five analysed studies[15,16,19–21] (398 patients) showed that patients who underwent PSP were more likely than those who underwent ECD to develop Frey syndrome (OR = 0.12, 95% CI: 0.03–0.48; $p = 0.003$; Fig. 4A). There was no significant between-study heterogeneity ($\chi^2 = 3.07$, $df = 2$, $p = 0.220$; $I^2 = 35\%$).

Recurrence

Complete recurrence data were provided by two studies[17,21], including a total of 277 patients. The recurrence rates were similar for the ECD and PSP patients (OR = 0.17, 95% CI: 0.02–1.75; $p = 0.14$; Fig. 4B). Due to the lack of significant between-study heterogeneity ($\chi^2 = 0.39$, $df = 1$, $p = 0.53$; $I^2 = 0\%$), a fixed-effects model was used.

Infection

Analysable infection data were available from three studies[16,20,21] involving a total of 256 patients. Pooling of the data showed that the postoperative infection rates did not differ significantly between the ECD and PSP groups (OR = 0.70, 95% CI: 0.07–6.67; $p = 0.76$; Fig. 4C).

Salivary fistula or sialocele

Analysable salivary fistula/sialocele data were available from three studies[16,20,21] involving a total of 256 patients. Pooling of the data revealed no significant difference between the ECD and PSP groups in terms of the rates of salivary fistula/sialocele (OR = 0.40, 95% CI: 0.06–2.66; $p = 0.350$; Fig. 4D).

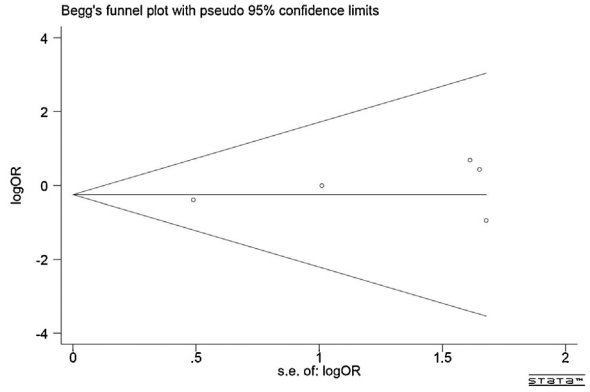

Fig. 3. Begg's funnel plot for assessing publication bias of permanent facial nerve injury. OR, odds ratio; SE, standard error.

Discussion

Although many studies have reported on the suitability of various treatments for BPTs, few have provided statistical comparisons between ECD and PSP. Surgeons previously preferred SP to PSP based on the presumption that the larger amount of residual tumour tissue left, relative to that following SP, would be associated with a

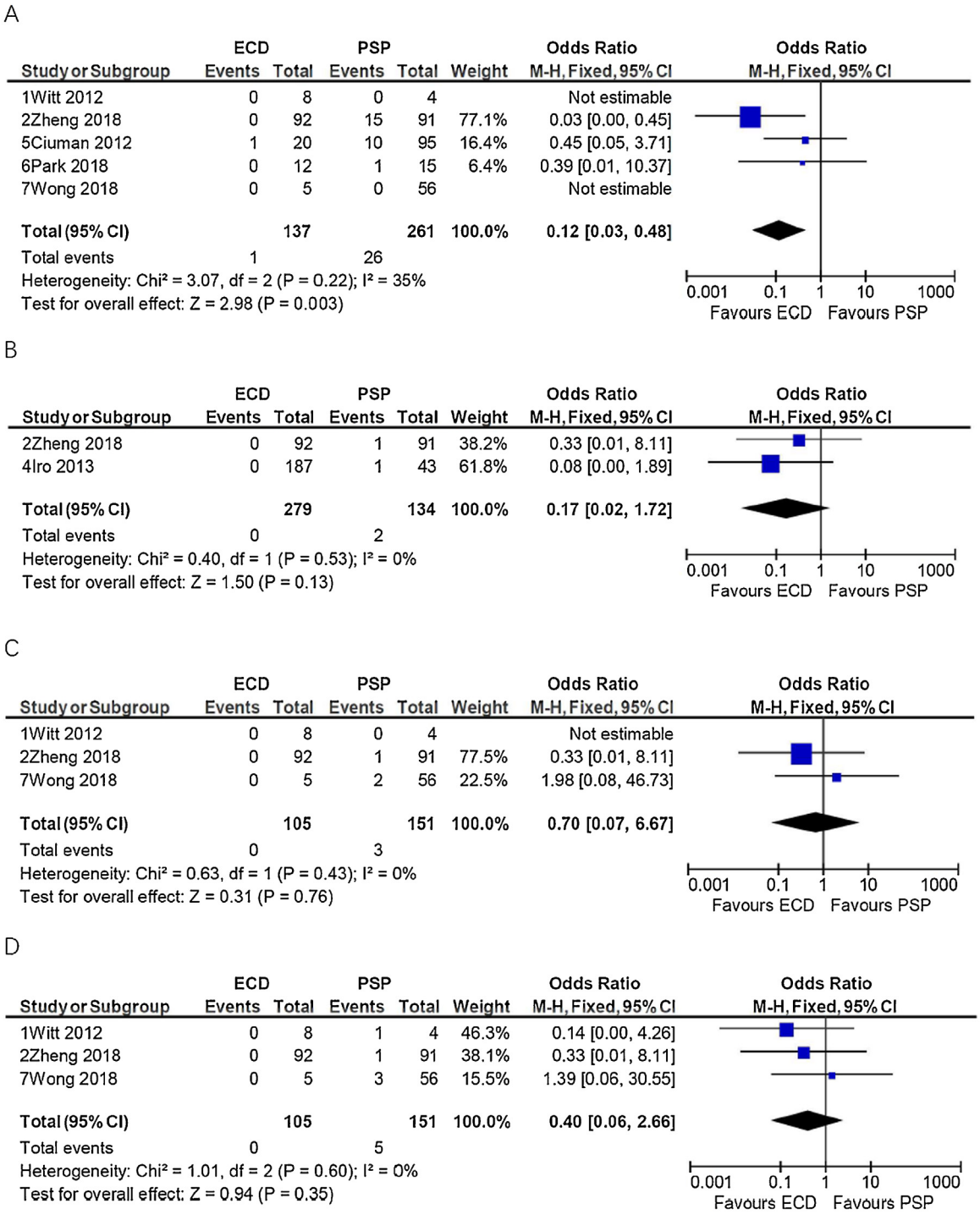

Fig. 4. Forest plot and meta-analysis of Frey syndrome (A), recurrence (B), infection (C) and salivary fistula or sialocele (D).

greater risk of recurrence. Several meta-analyses[22–24] comparing ECD with SP have reported that ECD is associated with acceptable rates of recurrence and limited complications. However, in recent years, PSP has become an important surgical option for the treatment of BPTs. Although some studies have reported that ECD is superior to PSP for treating BPTs, no study or meta-analysis comparing ECD with PSP has included a large number of patients. The findings of the present meta-analysis support the assertion that ECD is superior to PSP for treating BPTs in the context of transient facial nerve injury and Frey syndrome. The incidence of recurrence was slightly higher in the PSP group, compared with the ECD group, but this trend was not significant.

Our meta-analysis indicated that there was a higher risk of transient facial nerve injury with PSP, compared with ECD, but there was no significant difference in the risk of permanent facial nerve injury. Only two[15,21] of the included studies reported a significant difference. Our finding of a

lower incidence of transient facial nerve injury in the ECD group, compared with the PSP group, is probably attributable to the fact that fewer nerves need to be clamped and dissected away from the tumour in ECD, compared with PSP. Hence, with ECD, there is a reduced possibility of transient injury to the nerve. Severing of a nerve during surgery results in permanent nerve injury. The data obtained from this meta-analysis indicate that the risk of permanent facial nerve injury was similar with ECD and PSP; however, the lack of a significant difference between the two groups may be due to the relatively small number of cases included. Notwithstanding, it is vital for surgeons to obtain a clear understanding of each patient's facial nerve anatomy, regardless of the surgical method employed, in order to minimize the risk of facial nerve injury. All of the surgeons who operated on patients in the included studies were highly experienced.

Our meta-analysis indicated a higher risk of Frey syndrome with PSP than with ECD. Three[15,18,21] of the five included studies reported a significant increase in the risk of Frey syndrome with PSP as compared with ECD. The precise cause of Frey syndrome is not fully understood. The most widely accepted hypothesis is that it may result from simultaneous damage to sympathetic and parasympathetic nerves near the parotid glands in the face or neck, followed by abnormal reconnection of regenerated nerve fibres. The most parsimonious explanation for the syndrome is that regenerated parasympathetic fibres that are supposed to trigger saliva production in the parotid glands in response to tasting food now synapse on improper targets, resulting in the activation of sweat glands and the dilation of blood vessels[25]. The decreased incidence of Frey syndrome observed after ECD, compared with PSP, is probably due to the fact that less tissue is cut during ECD, compared with PSP, resulting in a reduced risk of nerve injury, as observed for transient facial nerve injury.

The rate of BPT recurrence tended to be lower for ECD than for PSP, but this difference was not significant. Notably, only two studies observed recurrence. The lack of recurrence in the remaining five studies[15–16,18–20] may have been due to the relatively short follow-up periods. Indeed, Witt and Nicolai[26] found that tumours tended to recur 7–10 years after resection. Although recurring tumours are benign, it is important to avoid recurrence because secondary operations are associated with a higher risk of facial nerve injury and complications related to Frey syndrome[27]. The tumour subtype is also a factor in recurrence risk. In this meta-analysis, it was not possible to analyse the cases by the tumour subtype because this information was not available in the studies analysed. Future BPT studies should consider the tumour subtype.

We did not observe a difference between the two groups in terms of the incidence of infection. The risk of infection is a ubiquitous concern, regardless of the procedure elected. The incidence of infection depends on adequate establishment of aseptic conditions and operator awareness as well as postoperative wound care and dressing changes.

Salivary fistulas and sialoceles are caused by accidental cutting of the parotid duct. They are serious complications that require surgical correction if healing does not occur within 2 weeks. Although we did not find a significant difference between the ECD and PSP groups in terms of the incidence of salivary fistula/sialocele, we would expect ECD to carry a reduced risk of these complications than PSP because the former procedure involves the cutting of less tissue. Additional clinical studies with larger numbers of patients and operators with various levels of experience should be conducted to clarify the risks of these complications across procedures and across levels of professional experience.

SP has been primarily replaced by PSP because of postoperative aesthetic considerations expressed by patients. Two of the studies included in this meta-analysis reported on aesthetic outcomes; however, neither study found a significant difference between ECD and PSP.

The present meta-analysis had several limitations. First, all of the included studies were cohort studies; no randomized controlled trials were included. The included studies were carried out in clinical centres with varying levels of surgical expertise among the staff members. The protocols also varied among institutions. In addition, as in all cohort studies, the patients in the two groups may not be similar, which could potentially account for differences in outcomes between the two methods. Second, our analysis focused on only six postoperative outcomes, which do not provide a fully comprehensive view of ECD and PSP. Third, we did not observe significant heterogeneity with respect to outcomes, but numerous factors may have contributed to nonsignificant heterogeneity, including the tumour size, patient age and patient gender. Fourth, the duration of follow-up in the analysed studies was not long enough to demonstrate long-term outcomes. Fifth, our meta-analysis did not analyse cosmetic outcomes, which contribute substantially to the selection of a surgical approach. Finally, because this meta-analysis was conducted at the study level, it did not address or incorporate individual factors at the patient level.

The present results are not sufficient to conclude that ECD is more beneficial than PSP for patients with BPTs. Moreover, the etiologies of postoperative complications have not been fully elucidated. Nonetheless, we hope to minimize the incidence of parotid gland tumour removal while maximizing the long-term benefits of the operation. The results of our meta-analysis suggest that the use of the ECD technique may lead to a better prognosis than PSP. Therefore, the use of PSP as a treatment for BPTs should be reassessed.

In conclusion, this meta-analysis assessed the best evidence available for guiding clinical decisions regarding BPT resection, with the aim of minimizing complications. The results of this meta-analysis favoured ECD, which conserves more tissue than PSP, thereby reducing the occurrence of complications. Because the level of the clinician's experience may influence the outcomes of BPT treatment, we recommend that these operations be performed selectively by experienced surgeons. Future well-designed, randomized clinical trials with a large number of patients and an extensive follow-up period are needed to confirm and update the findings of this analysis.

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Competing interests

None.

Ethical approval

Not required.

Patient consent

Not required.

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