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Treatment of benign lesion of levels I or II of the parotid gland: long term results of partial superficial parotidectomy --Manuscript Draft--

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Corresponding Author:	Irene Claudia Visconti, M.D Università di Roma I: Università degli Studi di Roma La Sapienza ITALY
Corresponding Author Secondary Information:	
Corresponding Author's Institution:	Università di Roma I: Università degli Studi di Roma La Sapienza
Corresponding Author's Secondary Institution:	
First Author:	Irene Claudia Visconti, M.D
First Author Secondary Information:	
Order of Authors:	Irene Claudia Visconti, M.D Giannicola Iannella, Ospedale G.B Morgagni- L. Pierantoni, Forli Italy Giuseppe Meccariello Giovanni Cammaroto Giampiero Gulotta Antonio Greco Marco de Vincentiis Giuseppe Magliulo Stefano Pelucchi Antonino Maniaci Salvatore Cocuzza Ignazio La Mantia Bruno Carlo Brevi Claudio Vicini
Order of Authors Secondary Information:	
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Abstract:	The correct surgical approach to benign parotid gland tumors is still matter of debate, it should be chosen considering the possibility of local recurrence or facial nerve complications in case of "not necessary" facial nerve dissection. In the era of minimally invasive surgery, more sparing approaches such as extracapsular dissection or partial superficial parotidectomy are gaining popularity. The aim of the study is to present surgical results and long-term outcomes of partial superficial parotidectomy (Level I or

II) in a large group of patients. 651 patients who underwent parotid surgery between 2004 and 2020 were initially considered. 540 patients with benign lesions treated with partial superficial parotidectomy (PSP), enucleation, extra capsular dissection (ECD) were enrolled. Clinical features, surgical data, post-operative scarring, seroma, dehiscence, neuroma, outcomes as Frey's syndrome and delayed facial nerve dysfunction have been evaluated. 65,5% partial superficial parotidectomy, 25,2% enucleation and 9.2% extracapsular dissection. No statistically difference in surgical time has been found ($p = 0.16$). $P > 0.05$ for seroma, neuroma, Frey's syndrome and facial palsy between different type of surgery. Frey's syndrome in partial superficial parotidectomy: 6/135 (4,4%) in 2004-2012 and 2/219 (0,9%) in 2013-2020. The reduction between periods is significant ($p < 0.04$). Recurrence: 0,8% (3/354) for PSP patients, 3,4% (5/136) in enucleation and 10% (5/50) in ECD ($p = 0.02$). Partial superficial parotidectomy can be considered a minimally invasive and quick procedure with low complication rate. Our data seems to support this statement (large case series and long-term follow-up).

COVER LETTER

Dear Editor,

I would like to submit the paper entitled "Treatment of benign lesion of levels I or II of the parotid gland: long term results of partial superficial parotidectomy" for eventual publication on The Journal of Craniofacial surgery.

Only few studies have evaluated and discussed partial superficial parotidectomy outcomes with scarce or partially incomplete data in terms of long term follow up. So, the purpose of this retrospective study is to present surgical results and long-term outcomes of partial superficial parotidectomy in large group of patients suffering from benign lesions of parotid gland in a single Institution.

The manuscript has not been previously published or submitted elsewhere for review.

Best regards,

Irene Claudia Visconti (corresponding author)

CONFLICT OF INTEREST

All the authors declare no conflict of interest.

Address correspondence and reprint requests to Irene Claudia Visconti

Department of "Organi di Senso", "La Sapienza" University of Roma,

Viale dell'Università 33, 00183 Roma, Italy,

Phone: +393271288757

Email: ireneclaudia.visconti@gmail.com

Dear reviewers,

I would like to thank you for your valuable comments. As advised by you, we have brought together the discussion part and the conclusions.

1 **Title**

2

3 **Treatment of benign lesion of levels I or II of the parotid gland: long term results of partial**
4 **superficial parotidectomy**

5

6 **Authors**

7 Irene Claudia Visconti¹, Giannicola Iannella^{1,2}, Giuseppe Meccariello², Giovanni Cammaroto²,
8 Giampiero Gulotta¹, Antonio Greco¹, Marco de Vincentiis¹, Giuseppe Magliulo¹, Stefano Pelucchi³,
9 Antonino Maniaci⁴, Salvatore Cocuzza⁴, Ignazio La Mantia⁴, Bruno Brevi⁵, Claudio Vicini^{2,3}

10

11 **Affiliation(s)**

12 ¹ Department of “Organi di Senso”, “La Sapienza” University of Rome, Rome, Italy

13 ² Department of Head-Neck Surgery, Otolaryngology, Head-Neck and Oral Surgery Unit, Morgagni
14 Pierantoni Hospital, Forli, Italy

15 ³ Ear-Nose-Throat & Audiology Unit, University of Ferrara, 44121 Ferrara, Italy

16 ⁴ Department of Medical and Surgical Sciences and Advanced Technologies "GF Ingrassia", ENT
17 Section, University of Catania, 95100 Catania, Italy.

18 ⁵ Complex Operating Unit of Maxillo-Facial Surgery, Azienda Ospedaliero-Universitaria Pisana, Via
19 Paradisa 2, 56100 Pisa, Italy.

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21 **Type of Article**

22 *Original Article*

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24 **Corresponding author**

25

26 Irene Claudia Visconti

27 Department of “Organi di Senso”, “La Sapienza” University of Roma,

28 Viale dell’Università 33, 00183 Roma, Italy,

29 Phone: +393271288757

30 Email: ireneclaudia.visconti@gmail.com

31

32 The authors declare no conflict of interest or source of founding

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1 **Abstract**

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3 be chosen considering the possibility of local recurrence or facial nerve complications in case
4 of “not necessary” facial nerve dissection. In the era of minimally invasive surgery, more
5 sparing approaches such as extracapsular dissection or partial superficial parotidectomy are
6 gaining popularity. The aim of the study is to present surgical results and long-term outcomes
7 of partial superficial parotidectomy (Level I or II) in a large group of patients. 651 patients who
8 underwent parotid surgery between 2004 and 2020 were initially considered. 540 patients with
9 benign lesions treated with partial superficial parotidectomy (PSP), enucleation, extra capsular
10 dissection (ECD) were enrolled. Clinical features, surgical data, post-operative scarring,
11 seroma, dehiscence, neuroma, outcomes as Frey’s syndrome and delayed facial nerve
12 dysfunction have been evaluated. 65,5% partial superficial parotidectomy, 25,2% enucleation
13 and 9.2% extracapsular dissection. No statistically difference in surgical time has been found
14 ($p=0.16$). $P>0.05$ for seroma, neuroma, Frey’s syndrome and facial palsy between different type
15 of surgery. Frey’s syndrome in partial superficial parotidectomy: 6/135 (4,4%) in 2004-2012
16 and 2/219 (0,9%) in 2013-2020. The reduction between periods is significant ($p <0.04$).
17 Recurrence: 0,8% (3/354) for PSP patients, 3,4% (5/136) in enucleation and 10% (5/50) in ECD
18 ($p=0.02$). Partial superficial parotidectomy can be considered a minimally invasive and quick
19 procedure with low complication rate. Our data seems to support this statement (large case
20 series and long-term follow-up).

21

22 **Key words**

23 partial superficial parotidectomy, enucleation, extracapsular dissection, pleomorphic adenoma,
24 salivary glands

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26 **Declarations**

27 The authors declare no financial/conflict of interest or source of funding.

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36 **Introduction**

37 The European Salivary Gland society has divided parotid gland in V levels; among them the I
38 and II represent the lateral superior and lateral inferior portion, respectively [1].

39 Different surgical choices have been described for treating benign tumors of the parotid gland
40 limited to one portion of the superficial lobes of the gland: Extracapsular Dissection (ECD) [2],
41 Superficial Parotidectomy (SP) [3], Partial Superficial Parotidectomy (PSP) [4], Enucleation
42 (En) [5].

43 Among them, the correct approach (more or less radical) is still matter of debate [6] and it
44 should be chosen considering the possibility of local recurrence in case of under-resection
45 (undertreatment) or facial nerve complications in case of “not necessary” facial nerve
46 identification and dissection (overtreatment). Therefore, in the era of minimally invasive
47 surgery, the tendency is moving to more sparing approaches such offered by an extracapsular
48 dissection or partial superficial parotidectomy.

49 Usually superficial parotidectomy (level I and II according to the European Salivary Gland
50 classification) has been performed for lesions that involved the superficial portion of the parotid
51 gland regardless of the affected lobe [7]. However, over the years, for lesions involving just one
52 lobe of the parotid gland, partial superficial parotidectomy (level I or II) has been proposed as
53 an alternative to extracapsular dissection. This surgical technique consists of resection of the
54 upper or lower pole affected, after having identified the facial nerve. So, less gland tissue is
55 removed and fewer branches are dissected reducing the risk of facial nerve damage. Besides,
56 Stathopoulos et al [8] in their paper reported less intraoperative and postoperative complications
57 and better surgical outcomes when comparing partial superficial parotidectomy to the
58 traditional superficial parotidectomy.

59 Although recent studies [9,10] have shown excellent results of extra capsular dissection, we
60 strongly feel that partial superficial parotidectomy may be considered, in terms of aesthetic
61 results and low rate of complications, as a minimally invasive approach to which is added the
62 security of having visualized and preserved facial nerve branches.

63 Few studies have evaluated and discussed partial superficial parotidectomy outcomes [11,12].
64 Besides, long-term follow-up data are inconsistent and partially incomplete.

65 The purpose of this retrospective study is to present surgical results and long-term outcomes of
66 partial superficial parotidectomy (level I or II) in a large group of patients suffering from benign
67 lesions of just one level of the superficial parotid gland.

68 **Materials and Methods**

69 *Study design*

70 All patients who underwent parotid gland surgery in the period between November 2004 and
71 April 2020 at Morgagni Pierantoni Hospital of Forlì, were initially evaluated for inclusion in
72 this study (651 cases).

73 In order to assess outcomes of partial superficial parotidectomy, patients treated for benign
74 neoplasm in one of lateral superficial lobe (level I or II) of the parotid gland, were enrolled in
75 the study. We also included in the study analysis patients who underwent extracapsular
76 dissection and enucleation to compare their results with partial superficial parotidectomy. We
77 used these two different options in a minority of cases, for superficial and mobile neoformations
78 less than 1 cm in diameter.

79 Patients with malignant neoformation or who underwent total parotidectomy (Levels I-IV) or
80 deep lobectomy (Levels III and IV) were excluded from the study. Among patients who had
81 benign tumour of superficial parotid gland (Levels I or II), we have also excluded subjects with
82 lesions involving either level I or II and so underwent to complete superficial parotidectomy.

83 Patient with incomplete data or lost at follow-up were also excluded from the study.

84 All patients who needed parotid gland surgery were preoperatively evaluated with ultrasound
85 (US) or Computed Tomography (CT) or Magnetic Resonance Imaging (MRI) examination and
86 fine needle aspiration cytology (FNAC) or TRU CUT biopsy.

87 The study method is highlighted in the flowchart (*Fig 1*)

88 *Outcomes evaluated*

89 The total of 540 patients with benign neoformations of level I or II treated with partial
90 superficial parotidectomy, enucleation or extracapsular dissection has been compared in the
91 study analysis.

92 They were composed by 242 male and 298 females with an average age of 54.2 years.

93 Partial superficial parotidectomies were categorised according to the site of the neoformation
94 using the European Salivary Gland classification⁷ in Superior Superficial Lobectomy (Level I),
95 Inferior Superficial Lobectomy (Level II).

96 Patients clinical characteristics, surgical data (type of incision, eventual resection of external
97 jugular vein, sparing of Greater Auricular nerve) type of partial superficial parotidectomy
98 (superior or inferior lobectomy), intraoperative facial nerve involvement, post-operative
99 scarring, postoperative complications (seroma, dehiscence, neuroma), and outcomes as Frey's
100 syndrome and delayed facial nerve dysfunction have been evaluated for all of the three groups.

101 Definitive outcomes have been analyzed with a follow-up ranged from 3 months to 15 years
102 with an average long-term of 10.8 years.

103 All patients underwent serial ultrasound scans: the first one after six months from surgery and
104 then annually performed. To the follow-up, in case of undefined US characteristics in remaining
105 parotid gland, patients performed MRI. A total of 27 patients were lost at follow up. Data of
106 any recurrences were those detected at the latest follow-up.

107 Patients who underwent superficial parotidectomy in the period of 2004-2020 were also split in
108 two groups: 2004-2012 and 2013-2020; this, with the aim of investigating the different rate of
109 complications related to the period in which the surgery was performed and, consequently, to
110 the expertise of the surgical team.

111 All procedures were performed by all members of the surgical team with a standard surgical
112 point. Common setting was used for all the procedures: Zeiss Loupe®, Neuromapping by
113 monopolar and bipolar probe, Shah's Hemostatic Thermal Scalpel®, Mini Hemo Drain®, no
114 muscle flap has been used.

115 *Statistical analysis*

116 The Chi-squared (χ^2) test and U- Mann Whitney test have been used to evaluate the significance
117 of the multiple factors analysed, when possible. The one-way ANOVA test has been used to
118 compare means. A p value of <0,05 was chosen as threshold of statistical significance.

119 **Results**

120 Regarding enrolled patients: 65.5% (354) underwent partial superficial parotidectomy; 25.2%
121 (136) enucleation and 9.2% (50) extracapsular dissection. Among the total of 354 partial
122 superficial parotidectomies, we performed 114 superior superficial lobectomies (level I), 240
123 inferior superficial lobectomies (level II).

124 A detail of the surgical profiles and the relative surgical time of the different procedures of our
125 selected series is summarized in **Tab. 1 Supplemental**

126 Comparing means of surgical time, no statistically significant difference has been found (F-
127 ratio value was 1.90. P value was 0.16).

128 At the definitive histological examination, among 540 patients, pleomorphic adenoma was the
129 most represented, followed by cystoadeno-lymphoma (Warthin tumor). The total set of
130 pathological diagnoses have been summarized in **Fig. 2**

131 The characteristics of complications and long-term outcomes results are reported in **Tab. 2**
132 **Supplemental**

133 $p > 0.05$ for seroma, neuroma, Frey's syndrome and facial palsy comparison of different type
134 of surgery.

135 The occurrence of Frey's syndrome in the whole group of 540 patients had a median onset of
136 12 months (range: 4–20 months).

137 **Figure 3 (Fig. 3)** shows that over the years, there has been a constant increase in the execution
138 of partial superficial parotidectomy at our Institution, so when dividing incidence of Frey's
139 syndrome in patients treated with partial superficial parotidectomy by period, a clear reduction
140 in the 2013-2020 group is reported: 6/135 (4.4%) in 2004-2012 group and 2/219 (0.9%) in the
141 second. Comparing the two periods, the reduction is statistically significant ($p < 0.04$).

142 Globally, only 1.9% of recurrence has been described during follow up, with an average time
143 of 5.7 years from surgery (1year - 10.5 years): 0.8% (3/354) for partial superficial
144 parotidectomy patients, 3.4% (5/136) in those treated with enucleation and 10% (5/50) ECD.
145 Comparing the three techniques, no statistical difference emerged about possible recurrence
146 ($p > 0.05$ in all groups comparison).

147 **Discussion**

148 Different surgical options have been developed and are currently available for benign lesions
149 of the parotid gland. Enucleation, partial or total superficial parotidectomy and extracapsular
150 dissection are the most used. [5,13,14]. While enucleation has over time shown a recurrence
151 rate that has led many surgeons to prefer superficial parotidectomy and extracapsular dissection,
152 currently the best surgical approach is still debated. Schapher et al [15] in their recent study
153 presented a case series of 182 patients treated with ECD (29.7%) or other surgical modalities
154 (70.3%), presenting long term follow up data (13 years). They concluded that facial nerve palsy
155 and Frey's syndrome was strongly related to tumor size, location and surgical invasiveness. For
156 that reason, they believe that ECD should be considered as the surgical method of choice for
157 selected benign parotid lesions. Therefore, ECD seems to be registered as the most popular
158 procedure in the last few years.

159 Even though more and more researches on outcomes of extracapsular dissection are found in
160 literature [6,10,15]. this paper highlights how partial superficial parotidectomy, removing only
161 level I or II may be considered as minimally invasive as other approaches.

162 Preservation of the facial nerve remains one of the most important and challenging steps in
163 parotidectomy. Reducing the incidence of facial nerve involvement is the main goal of the
164 surgeon approaching to this type of surgery. Our results show significantly lower rates than
165 Henney et al. [16] Their retrospective study included 130 patients treated with parotidectomy
166 (120 superficial parotidectomies, 3 deep lobe parotidectomy and 7 complete one) in the period
167 1994-2006. They described a transient facial palsy in 42% of patients, which is higher than
168 4.2% reported by our group. Kilavuz et al [12] reported higher incidence of facial nerve
169 involvement (6.9%) in their partial superficial parotidectomy group composed by 131 patients
170 treated between 2006-2014. Prior studies [17,18] have also reported higher frequencies of
171 permanent facial palsy which has not been found in this study. In our center 2.5x Zeiss loupes®
172 are used for the identification and dissection of the branches of the facial nerve in agreement
173 with microsurgical techniques reported by some authors [19,20]. Neuromapping allows us to
174 locate the course of the main trunk and of all the minor branches of the facial nerve before
175 dissecting them free (*Fig. 4*). The use of Shah's Hemostatic Thermal Scalpel® ensures to cut
176 the parotid parenchyma without muscle twitching and in a really bloodless way.

177 Another interesting finding is that the incidence of temporary facial palsy in our patients treated
178 with partial superficial parotidectomy (4.2%) is comparable to that obtained after extracapsular
179 dissection (5.9%) by Schaper et al [15]. The post-operative management of facial palsy has

180 been done using a short course of oral steroid and no nerve reconstruction technique has been
181 required [21]. The significantly reduction of incidence in the period 2013-2020 lead us to
182 consider that the surgical team experience is an important factor in performing a safe dissection
183 of the facial nerve trunks and so it has a decisive impact on postoperative facial palsy. No
184 studies in literature has been found regarding this aspect. It is worth to mention that partial
185 superficial parotidectomy (level I or II) combines the great advantage to directly identify and
186 anatomically preserve facial nerve in all the cases and to dissect only the nerve inside the level
187 required. The advantages are manifolds. Firstly, all the maneuvers are carried out under direct
188 visualization, in order to avoid inadvertently cutting to minor branches. Secondly, a systematic
189 training in locating the VII nerve trunk tends to increase the Team expertise also when facial
190 nerve dissection is mandatory. Finally, in Partial Superficial Parotidectomy (level I or II) no
191 dissection is carried out in areas far from the tumor.

192 Excellent results were also highlighted in this paper in terms of incidence of Frey's Syndrome.
193 In literature, many papers focus on the high rate in patients treated with superficial
194 parotidectomy compared to those with extracapsular dissection. Herein, however, a comparison
195 between procedures cannot be performed as we prefer to use ECD only in selected patients and
196 therefore the sample would not be homogeneous. Anyway, the incidence of 0.9% in the period
197 2013-2020 in partial superficial parotidectomy patients is a promising result, significantly lower
198 than the one presented in case of superficial parotidectomy by Kadletz et al [22]. The authors
199 included patients treated either with Superficial Parotidectomy (levels I and II) or Partial
200 Superficial Parotidectomy (level I or II) in one group and compared it with the one of ECD
201 patients. They described a rate of 10.9% in the first group and 0% in case of ECD.
202 Unfortunately, having included Partial Superficial Parotidectomy in the group of Superficial
203 Parotidectomies does not allow us to determine the real incidence of Frey's syndrome in case
204 of PSP.

205 In terms of recurrence rate no difference between Partial Superficial Parotidectomy and ECD
206 has been found when searching in literature. In particular, Lin et al [23] in their recent meta-
207 analysis reported data of a total of 277 patients and no statistically significant difference
208 between ECD and PSP patients ($p = 0.14$).

209 This work highlights how the results obtained after partial superficial parotidectomy (level I or
210 II) are substantially similar to those of ECD. We agree with Lin et al [23] who stated that it was
211 not possible to determine which technique is superior.

212 Unfortunately, our work is not configured as a comparison between techniques and therefore
213 it is not possible to integrate the data presented by Lin [23].

214 Last but not least, it should be noted that no substantial differences have been found in terms of
215 surgical time. No studies have been found in the literature focusing on surgical times of each
216 approach or comparing them.

217 In conclusion, partial superficial parotidectomy can be considered a minimally invasive and
218 quick procedure with a very low complication rate. This statement is supported by the large
219 case series and long-term follow-up period.

220

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223

224 **List of abbreviations**

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226 **CI:** Interval of Confidence

227 **CT:** Computed Tomography

228 **ECD:** Extracapsular dissection

229 **En:** Enucleation

230 **FNAC:** Fine needle aspiration cytology

231 **MRI:** Magnetic Resonance Imaging

232 **OR:** Odds ratio

233 **PSP:** Partial Superficial Parotidectomy

234 **SP:** Superficial Parotidectomy

235 **US:** Ultrasound

236 **χ^2 :** Chi-squared test

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241

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317

318 ***Figures legend:***

319 ***Figure 1 Study Design***

320 ***Figure 2 Final Pathological Diagnoses***

321 ***Figure 3 Partial Superficial Parotidectomy over the years***

322 ***Figure 4 A: Facial nerve dissection during PSP detecting the course of the main trunk***
323 ***(arrow) and of the minor branches of the facial nerve of the involved lobe. B: Facial nerve***
324 ***(arrow) and remnant parotid parenchyma***

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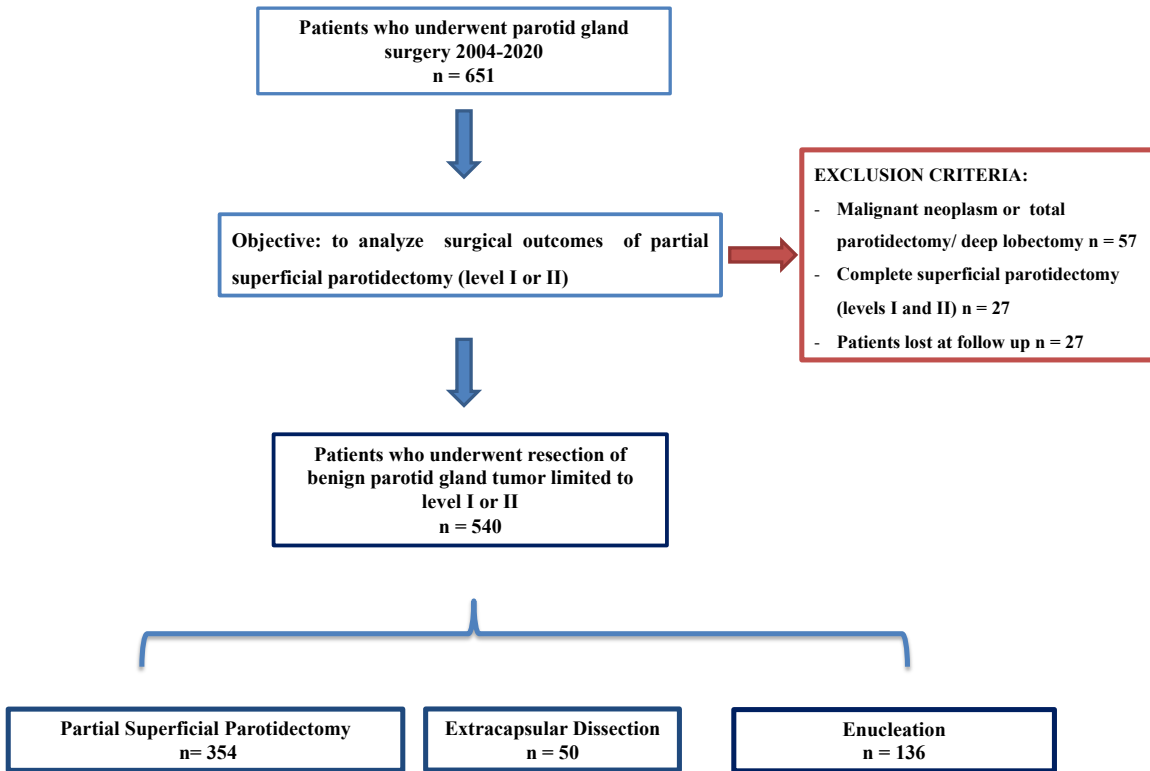
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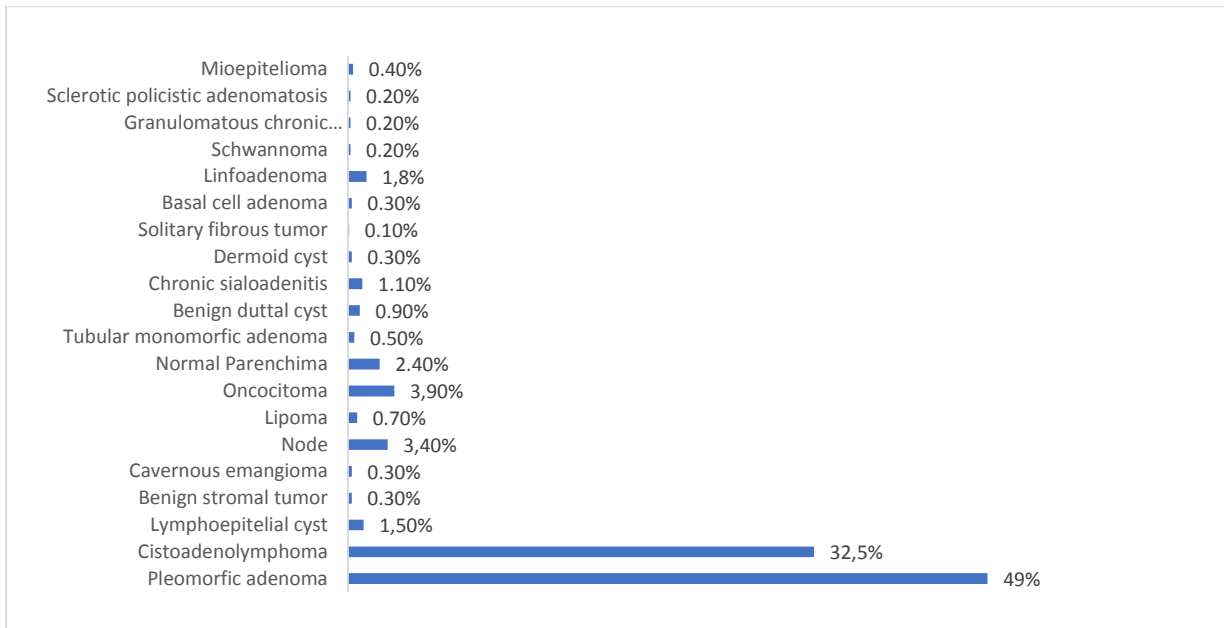
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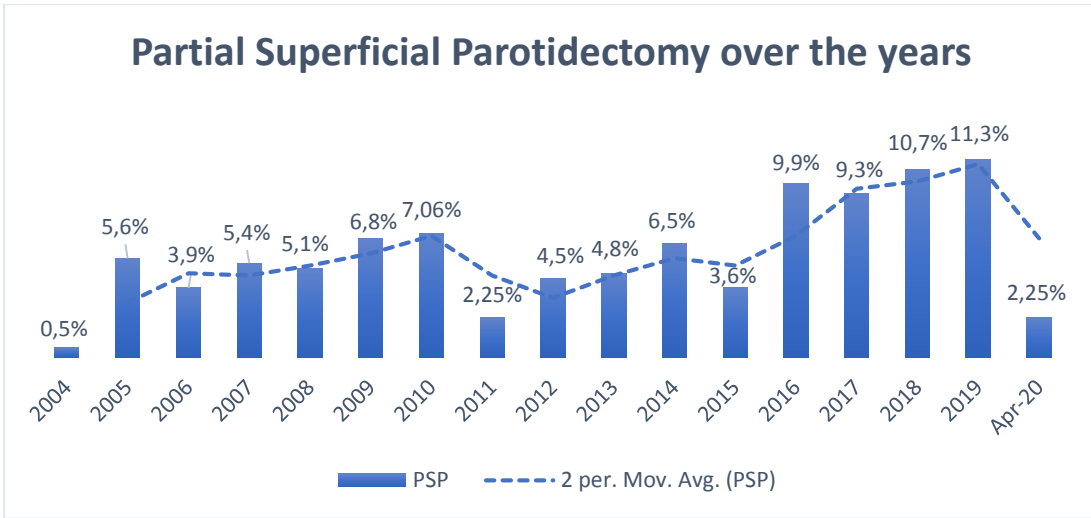
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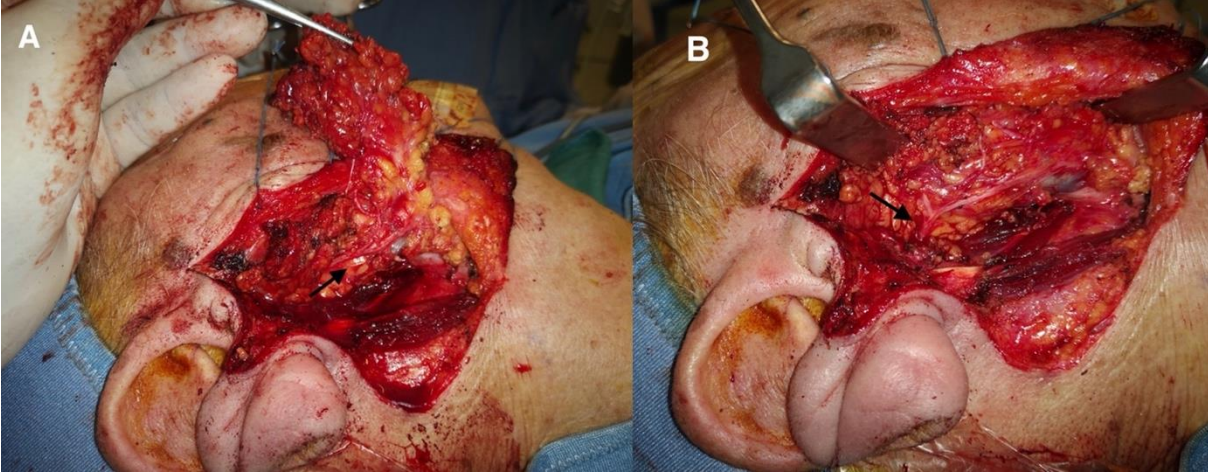
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1 **SUPPLEMENTAL: TABLES**2
34 **Supplemental Tab 1. Surgical time and profiles**

		PSP	ECD	Enucleation	p
SURGICAL TIME		81.36 min (range 70-110 min)	76.45 min (range 60-100 min)	68.27 min (range 60-95 min)	p> 0.05
INCISION	Redon	268/354 (75.7%)	50/50 (100%)	103/136 (76.1%)	---
	Face Lift	86/354 (24%)	0/50 (0%)	33/136 (23.8%)	---
EXTERNAL JUGULAR VEIN	Spared	349/354 (98.5%)	50/50 (100%)	132/136 (97.7%)	p> 0.05
	Resected	5/354 (0.14%)	0/50 (0%)	4/136 (2.2%)	p> 0.05
GREATER AURICULAR NERVE	Spared	348/354 (98%)	50/50 (100%)	134/136 (98.8%)	p> 0.05
	Interrupted	6/354 (0.15%)	0/50 (0%)	2/136 (1.1%)	p> 0.05

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67 **Supplemental Tab 2. Complications and outcomes**

	PSP	Enucleation	ECD	p
Seroma	16.1% (57/354)	21% (29/136)	30% (15/50)	p> 0.05
Neuroma	1.1% (4/354)	0.5% (1/136)	0% (0/50)	p> 0.05
Frey's Syndrome	2.2% (8/354)	1.7% (3/136)	0% (0/50)	p> 0.05
Facial Palsy	4.2% (15/354)	3.4% (5/136)	1% (5/50)	p> 0.05
Local Relapse	0.8% (3/354)	3.4% (5/136)	1% (5/50)	p> 0.05

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1 **Abstract**

2 The correct surgical approach to benign parotid gland tumors is still matter of debate, it should
3 be chosen considering the possibility of local recurrence or facial nerve complications in case
4 of “not necessary” facial nerve dissection. In the era of minimally invasive surgery, more
5 sparing approaches such as extracapsular dissection or partial superficial parotidectomy are
6 gaining popularity. The aim of the study is to present surgical results and long-term outcomes
7 of partial superficial parotidectomy (Level I or II) in a large group of patients. 651 patients who
8 underwent parotid surgery between 2004 and 2020 were initially considered. 540 patients with
9 benign lesions treated with partial superficial parotidectomy (PSP), enucleation, extra capsular
10 dissection (ECD) were enrolled. Clinical features, surgical data, post-operative scarring,
11 seroma, dehiscence, neuroma, outcomes as Frey’s syndrome and delayed facial nerve
12 dysfunction have been evaluated. 65,5% partial superficial parotidectomy, 25,2% enucleation
13 and 9.2% extracapsular dissection. No statistically difference in surgical time has been found
14 (p 0.16). $P > 0.05$ for seroma, neuroma, Frey’s syndrome and facial palsy between different type
15 of surgery. Frey’s syndrome in partial superficial parotidectomy: 6/135 (4,4%) in 2004-2012
16 and 2/219 (0,9%) in 2013-2020. The reduction between periods is significant ($p < 0.04$).
17 Recurrence: 0,8% (3/354) for PSP patients, 3,4% (5/136) in enucleation and 10% (5/50) in ECD
18 ($p = 0.02$). Partial superficial parotidectomy can be considered a minimally invasive and quick
19 procedure with low complication rate. Our data seems to support this statement (large case
20 series and long-term follow-up).

21

22 **Key words**

23 partial superficial parotidectomy, enucleation, extracapsular dissection, pleomorphic adenoma,
24 salivary glands

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26 **Declarations**

27 The authors declare no financial/conflict of interest or source of funding.

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36 **Introduction**

37 The European Salivary Gland society has divided parotid gland in V levels; among them the I
38 and II represent the lateral superior and lateral inferior portion, respectively [1].

39 Different surgical choices have been described for treating benign tumors of the parotid gland
40 limited to one portion of the superficial lobes of the gland: Extracapsular Dissection (ECD) [2],
41 Superficial Parotidectomy (SP) [3], Partial Superficial Parotidectomy (PSP) [4], Enucleation
42 (En) [5].

43 Among them, the correct approach (more or less radical) is still matter of debate [6] and it
44 should be chosen considering the possibility of local recurrence in case of under-resection
45 (undertreatment) or facial nerve complications in case of “not necessary” facial nerve
46 identification and dissection (overtreatment). Therefore, in the era of minimally invasive
47 surgery, the tendency is moving to more sparing approaches such offered by an extracapsular
48 dissection or partial superficial parotidectomy.

49 Usually superficial parotidectomy (level I and II according to the European Salivary Gland
50 classification) has been performed for lesions that involved the superficial portion of the parotid
51 gland regardless of the affected lobe [7]. However, over the years, for lesions involving just one
52 lobe of the parotid gland, partial superficial parotidectomy (level I or II) has been proposed as
53 an alternative to extracapsular dissection. This surgical technique consists of resection of the
54 upper or lower pole affected, after having identified the facial nerve. So, less gland tissue is
55 removed and fewer branches are dissected reducing the risk of facial nerve damage. Besides,
56 Stathopoulos et al [8] in their paper reported less intraoperative and postoperative complications
57 and better surgical outcomes when comparing partial superficial parotidectomy to the
58 traditional superficial parotidectomy.

59 Although recent studies [9,10] have shown excellent results of extra capsular dissection, we
60 strongly feel that partial superficial parotidectomy may be considered, in terms of aesthetic
61 results and low rate of complications, as a minimally invasive approach to which is added the
62 security of having visualized and preserved facial nerve branches.

63 Few studies have evaluated and discussed partial superficial parotidectomy outcomes [11,12].
64 Besides, long-term follow-up data are inconsistent and partially incomplete.

65 The purpose of this retrospective study is to present surgical results and long-term outcomes of
66 partial superficial parotidectomy (level I or II) in a large group of patients suffering from benign
67 lesions of just one level of the superficial parotid gland.

68 **Materials and Methods**

69 *Study design*

70 All patients who underwent parotid gland surgery in the period between November 2004 and
71 April 2020 at Morgagni Pierantoni Hospital of Forlì, were initially evaluated for inclusion in
72 this study (651 cases).

73 In order to assess outcomes of partial superficial parotidectomy, patients treated for benign
74 neoplasm in one of lateral superficial lobe (level I or II) of the parotid gland, were enrolled in
75 the study. We also included in the study analysis patients who underwent extracapsular
76 dissection and enucleation to compare their results with partial superficial parotidectomy. We
77 used these two different options in a minority of cases, for superficial and mobile neoformations
78 less than 1 cm in diameter.

79 Patients with malignant neoformation or who underwent total parotidectomy (Levels I-IV) or
80 deep lobectomy (Levels III and IV) were excluded from the study. Among patients who had
81 benign tumour of superficial parotid gland (Levels I or II), we have also excluded subjects with
82 lesions involving either level I or II and so underwent to complete superficial parotidectomy.

83 Patient with incomplete data or lost at follow-up were also excluded from the study.

84 All patients who needed parotid gland surgery were preoperatively evaluated with ultrasound
85 (US) or Computed Tomography (CT) or Magnetic Resonance Imaging (MRI) examination and
86 fine needle aspiration cytology (FNAC) or TRU CUT biopsy.

87 The study method is highlighted in the flowchart (*Fig 1*)

88 *Outcomes evaluated*

89 The total of 540 patients with benign neoformations of level I or II treated with partial
90 superficial parotidectomy, enucleation or extracapsular dissection has been compared in the
91 study analysis.

92 They were composed by 242 male and 298 females with an average age of 54.2 years.

93 Partial superficial parotidectomies were categorised according to the site of the neoformation
94 using the European Salivary Gland classification⁷ in Superior Superficial Lobectomy (Level I),
95 Inferior Superficial Lobectomy (Level II).

96 Patients clinical characteristics, surgical data (type of incision, eventual resection of external
97 jugular vein, sparing of Greater Auricular nerve) type of partial superficial parotidectomy
98 (superior or inferior lobectomy), intraoperative facial nerve involvement, post-operative
99 scarring, postoperative complications (seroma, dehiscence, neuroma), and outcomes as Frey's
100 syndrome and delayed facial nerve dysfunction have been evaluated for all of the three groups.

101 Definitive outcomes have been analyzed with a follow-up ranged from 3 months to 15 years
102 with an average long-term of 10.8 years.

103 All patients underwent serial ultrasound scans: the first one after six months from surgery and
104 then annually performed. To the follow-up, in case of undefined US characteristics in remaining
105 parotid gland, patients performed MRI. A total of 27 patients were lost at follow up. Data of
106 any recurrences were those detected at the latest follow-up.

107 Patients who underwent superficial parotidectomy in the period of 2004-2020 were also split in
108 two groups: 2004-2012 and 2013-2020; this, with the aim of investigating the different rate of
109 complications related to the period in which the surgery was performed and, consequently, to
110 the expertise of the surgical team.

111 All procedures were performed by all members of the surgical team with a standard surgical
112 point. Common setting was used for all the procedures: Zeiss Loupe®, Neuromapping by
113 monopolar and bipolar probe, Shah's Hemostatic Thermal Scalpel®, Mini Hemo Drain®, no
114 muscle flap has been used.

115 *Statistical analysis*

116 The Chi-squared (χ^2) test and U- Mann Whitney test have been used to evaluate the significance
117 of the multiple factors analysed, when possible. The one-way ANOVA test has been used to
118 compare means. A p value of <0,05 was chosen as threshold of statistical significance.

119 **Results**

120 Regarding enrolled patients: 65.5% (354) underwent partial superficial parotidectomy; 25.2%
121 (136) enucleation and 9.2% (50) extracapsular dissection. Among the total of 354 partial
122 superficial parotidectomies, we performed 114 superior superficial lobectomies (level I), 240
123 inferior superficial lobectomies (level II).

124 A detail of the surgical profiles and the relative surgical time of the different procedures of our
125 selected series is summarized in **Tab. 1 Supplemental**

126 Comparing means of surgical time, no statistically significant difference has been found (F-
127 ratio value was 1.90. P value was 0.16).

128 At the definitive histological examination, among 540 patients, pleomorphic adenoma was the
129 most represented, followed by cystoadeno-lymphoma (Warthin tumor). The total set of
130 pathological diagnoses have been summarized in **Fig. 2**

131 The characteristics of complications and long-term outcomes results are reported in **Tab. 2**
132 **Supplemental**

133 $p > 0.05$ for seroma, neuroma, Frey's syndrome and facial palsy comparison of different type
134 of surgery.

135 The occurrence of Frey's syndrome in the whole group of 540 patients had a median onset of
136 12 months (range: 4–20 months).

137 **Figure 3 (Fig. 3)** shows that over the years, there has been a constant increase in the execution
138 of partial superficial parotidectomy at our Institution, so when dividing incidence of Frey's
139 syndrome in patients treated with partial superficial parotidectomy by period, a clear reduction
140 in the 2013-2020 group is reported: 6/135 (4.4%) in 2004-2012 group and 2/219 (0.9%) in the
141 second. Comparing the two periods, the reduction is statistically significant ($p < 0.04$).

142 Globally, only 1.9% of recurrence has been described during follow up, with an average time
143 of 5.7 years from surgery (1year - 10.5 years): 0.8% (3/354) for partial superficial
144 parotidectomy patients, 3.4% (5/136) in those treated with enucleation and 10% (5/50) ECD.
145 Comparing the three techniques, no statistical difference emerged about possible recurrence
146 ($p > 0.05$ in all groups comparison).

147 **Discussion**

148 Different surgical options have been developed and are currently available for benign lesions
149 of the parotid gland. Enucleation, partial or total superficial parotidectomy and extracapsular
150 dissection are the most used. [5,13,14]. While enucleation has over time shown a recurrence
151 rate that has led many surgeons to prefer superficial parotidectomy and extracapsular dissection,
152 currently the best surgical approach is still debated. Schapher et al [15] in their recent study
153 presented a case series of 182 patients treated with ECD (29.7%) or other surgical modalities
154 (70.3%), presenting long term follow up data (13 years). They concluded that facial nerve palsy
155 and Frey's syndrome was strongly related to tumor size, location and surgical invasiveness. For
156 that reason, they believe that ECD should be considered as the surgical method of choice for
157 selected benign parotid lesions. Therefore, ECD seems to be registered as the most popular
158 procedure in the last few years.

159 Even though more and more researches on outcomes of extracapsular dissection are found in
160 literature [6,10,15]. this paper highlights how partial superficial parotidectomy, removing only
161 level I or II may be considered as minimally invasive as other approaches.

162 Preservation of the facial nerve remains one of the most important and challenging steps in
163 parotidectomy. Reducing the incidence of facial nerve involvement is the main goal of the
164 surgeon approaching to this type of surgery. Our results show significantly lower rates than
165 Henney et al. [16] Their retrospective study included 130 patients treated with parotidectomy
166 (120 superficial parotidectomies, 3 deep lobe parotidectomy and 7 complete one) in the period
167 1994-2006. They described a transient facial palsy in 42% of patients, which is higher than
168 4.2% reported by our group. Kilavuz et al [12] reported higher incidence of facial nerve
169 involvement (6.9%) in their partial superficial parotidectomy group composed by 131 patients
170 treated between 2006-2014. Prior studies [17,18] have also reported higher frequencies of
171 permanent facial palsy which has not been found in this study. In our center 2.5x Zeiss loupes®
172 are used for the identification and dissection of the branches of the facial nerve in agreement
173 with microsurgical techniques reported by some authors [19,20]. Neuromapping allows us to
174 locate the course of the main trunk and of all the minor branches of the facial nerve before
175 dissecting them free (*Fig. 4*). The use of Shah's Hemostatic Thermal Scalpel® ensures to cut
176 the parotid parenchyma without muscle twitching and in a really bloodless way.

177 Another interesting finding is that the incidence of temporary facial palsy in our patients treated
178 with partial superficial parotidectomy (4.2%) is comparable to that obtained after extracapsular
179 dissection (5.9%) by Schaper et al [15]. The post-operative management of facial palsy has

180 been done using a short course of oral steroid and no nerve reconstruction technique has been
181 required [21]. The significantly reduction of incidence in the period 2013-2020 lead us to
182 consider that the surgical team experience is an important factor in performing a safe dissection
183 of the facial nerve trunks and so it has a decisive impact on postoperative facial palsy. No
184 studies in literature has been found regarding this aspect. It is worth to mention that partial
185 superficial parotidectomy (level I or II) combines the great advantage to directly identify and
186 anatomically preserve facial nerve in all the cases and to dissect only the nerve inside the level
187 required. The advantages are manifolds. Firstly, all the maneuvers are carried out under direct
188 visualization, in order to avoid inadvertently cutting to minor branches. Secondly, a systematic
189 training in locating the VII nerve trunk tends to increase the Team expertise also when facial
190 nerve dissection is mandatory. Finally, in Partial Superficial Parotidectomy (level I or II) no
191 dissection is carried out in areas far from the tumor.

192 Excellent results were also highlighted in this paper in terms of incidence of Frey's Syndrome.
193 In literature, many papers focus on the high rate in patients treated with superficial
194 parotidectomy compared to those with extracapsular dissection. Herein, however, a comparison
195 between procedures cannot be performed as we prefer to use ECD only in selected patients and
196 therefore the sample would not be homogeneous. Anyway, the incidence of 0.9% in the period
197 2013-2020 in partial superficial parotidectomy patients is a promising result, significantly lower
198 than the one presented in case of superficial parotidectomy by Kadletz et al [22]. The authors
199 included patients treated either with Superficial Parotidectomy (levels I and II) or Partial
200 Superficial Parotidectomy (level I or II) in one group and compared it with the one of ECD
201 patients. They described a rate of 10.9% in the first group and 0% in case of ECD.
202 Unfortunately, having included Partial Superficial Parotidectomy in the group of Superficial
203 Parotidectomies does not allow us to determine the real incidence of Frey's syndrome in case
204 of PSP.

205 In terms of recurrence rate no difference between Partial Superficial Parotidectomy and ECD
206 has been found when searching in literature. In particular, Lin et al [23] in their recent meta-
207 analysis reported data of a total of 277 patients and no statistically significant difference
208 between ECD and PSP patients ($p = 0.14$).

209 This work highlights how the results obtained after partial superficial parotidectomy (level I or
210 II) are substantially similar to those of ECD. We agree with Lin et al [23] who stated that it was
211 not possible to determine which technique is superior.

212 Unfortunately, our work is not configured as a comparison between techniques and therefore
213 it is not possible to integrate the data presented by Lin [23].

214 Last but not least, it should be noted that no substantial differences have been found in terms of
215 surgical time. No studies have been found in the literature focusing on surgical times of each
216 approach or comparing them.

217 In conclusion, partial superficial parotidectomy can be considered a minimally invasive and
218 quick procedure with a very low complication rate. This statement is supported by the large
219 case series and long-term follow-up period.

220

221 **Acknowledgements**

222 The authors declare no financial/conflict of interest or source of funding.

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224 **List of abbreviations**

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226 **CI:** Interval of Confidence

227 **CT:** Computed Tomography

228 **ECD:** Extracapsular dissection

229 **En:** Enucleation

230 **FNAC:** Fine needle aspiration cytology

231 **MRI:** Magnetic Resonance Imaging

232 **OR:** Odds ratio

233 **PSP:** Partial Superficial Parotidectomy

234 **SP:** Superficial Parotidectomy

235 **US:** Ultrasound

236 **χ^2 :** Chi-squared test

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319 **Figures legend:**

320 **Fig. 1** Study design

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322 **Fig. 2** Final Pathological Diagnoses

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324 **Fig. 3** Partial Superficial Parotidectomy over the years

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326 **Fig. 4 A:** Facial nerve dissection during PSP detecting the course of the main trunk (arrow) and of all
327 the minor branches of the facial nerve of the involved lobe. **B:** Facial nerve (arrow) and remnant
328 parotid parenchyma.

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