



# Lingual Flap Protection during Third Molar Surgery: A Literature Review

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## Abstract

The purpose of this review was to analyze how the retraction and protection of lingual flap (LF+) could influence the incidence of lingual nerve injury (LNI) during third molar extraction, as compared with protocols that do not involve handling of lingual tissue (LF). A literature review was performed from the “Medline” and “Scopus” medical databases, using the keywords “lingual nerve” and “third molar surgery.” From the selected articles, the mean values for transitory and permanent LNI’s incidence were elaborated, taking into account the group treated with LF+ technique and the group treated with LF technique. Of 480 articles, 11 studies were included in the review. The LF+ group counted 3,866 surgeries and it resulted in a transitory LNI’s mean incidence of  $2.98 \pm 0.03\%$  and a mean incidence of  $0.1 \pm 0.003\%$  for permanent LNI. The LF group counted 5,938 surgeries with, respectively,  $1.92 \pm 0.02$  and  $0.49 \pm 0.006\%$  of transitory and permanent LNI’s incidence mean values. The results of this study suggest that the application of LF+ techniques reduces the risk of damage and injuries of lingual nerve.

## Keywords

- lingual flap
- lingual nerve
- third molar surgery

## Introduction

The iatrogenic damage of lingual nerve injury (LNI) during the surgical extraction of impacted third molars represents a noteworthy event of legal and medical importance.<sup>1</sup> Its incidence, as reported by the literature, is between 0 and 23% of surgeries, but authors are not always in accordance with its etiology, risk factors, and incidence.<sup>2,3</sup>

It is well known that the surgery of the impacted third molar represents the most frequently associated LNI,<sup>4</sup> but the exact causes of this complication mainly remain unknown.<sup>5</sup>

The association between LNI and the extraction of third molars is definitely dependent on the anatomical relationship between the two structures. Many studies highlight the closeness between the lingual nerve and third molar surgery site.<sup>6-10</sup>

Some studies<sup>11</sup> suggest that the prevention of LNI, particularly in case of permanent damage, is essential to avoid

the harmful action of rotary instruments on the lingual soft tissues that may occur during odontotomy or osteotomy. A relevant controversial topic linked to the LNI is the application of surgical techniques of elevation and lingual flap protection (LF+) to prevent LNI.<sup>12-15</sup>

The methods involving the manipulation of the lingual tissues during the extraction of the mandibular third molar were usually performed in hospital and contemplated the use of a Howarth’s periosteal elevator for the routine execution of the lingual flap and its protection (LF+). Successively, according to the results obtained with surgical protocols developed in the United States, surgery with the elevation of only one buccal flap (LF) spread further.<sup>12</sup> Actually, the debate on how and if lingual flap protection could affect the incidence of LNI is still open.<sup>5,16-22</sup>

This review aims to analyze the existing literature on this topic, to determine whether the LF+ techniques are effective

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in the prevention of LNI or whether they may cause an additional risk.

## Materials and Methods

### Literature Search

The study selection was performed by a literature search from the “Medline” and “Scopus” medical databases, using keywords “lingual nerve” and “third molar surgery.”

### Selection Criteria

1. Three types of studies were taken into account:
2. Observational studies that indicate the incidence of LNI in relation to a standard surgical technical report proposed by the author.
3. Prospective randomized studies, comparing the incidence of LNI in relation to the use of LF or LF+ techniques.

Randomized clinical studies, comparing the incidence of LNI in relation to the use of LF or LF+ techniques.

The first type of studies was included to assess the incidence of LNI on potentially inhomogeneous data samples, in absence of dependent variables resulting from the adoption of different surgical protocols.

Each of the selected studies, through the adoption of second and third inclusion criteria, showed two randomized samples of patients: one treated with LF+ technique and the other with LF technique.

These studies were included to evaluate the differences in terms of LNI incidence between the two techniques, excluding disturbance variables occurring from the selection of nonrandomized samples.

To assess the incidence of permanent LNI, studies with follow-up of less than 6 months were excluded. To get updated results from the most recent oral surgery, studies prior to 1990 were excluded. Moreover, studies with a sample cohort less than 200 elements were also excluded.

Several publications were excluded since they reported different surgical approach, rather than the only execution (or nonexecution) of elevation and protection of lingual flap. In fact, significant differences in surgical protocols adopted within the same study were frequently observed, and it was considered a disturbing element to the data analysis.

The choice of including studies with randomized samples only led to the exclusion of numerous articles. It has been frequently noticed an association between the application of LF+ protocols and different individual risk factors for LNI, while in other studies, the LF+ and LF samples were selected using undefined criteria. Therefore, such studies were judged unfit to compare the two techniques.

## Results

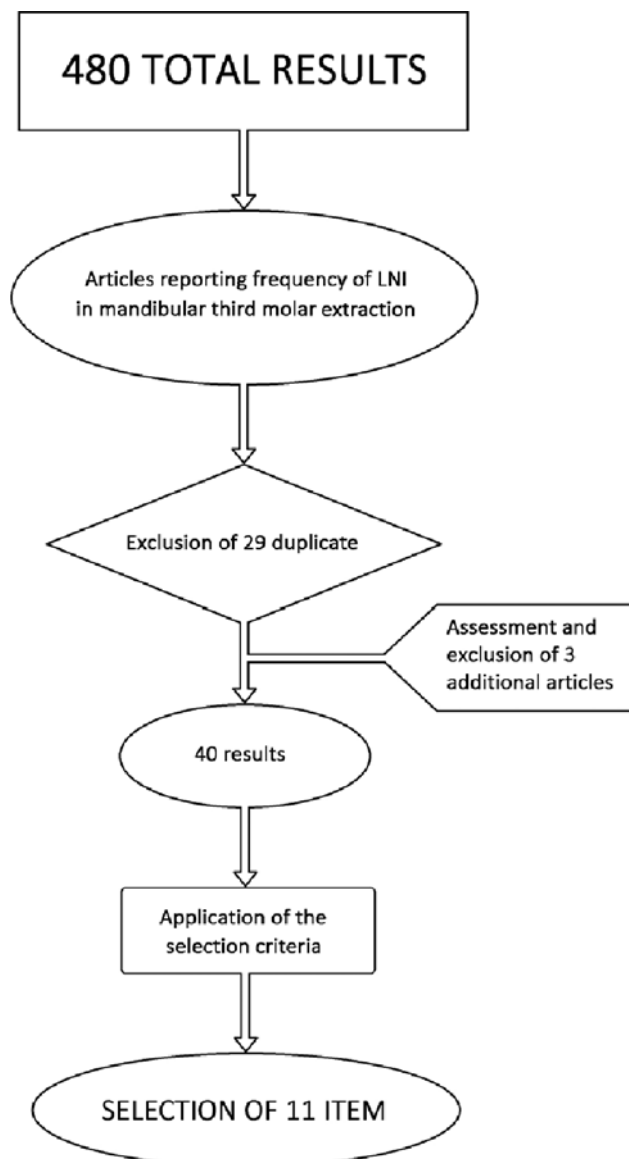
The search produced 480 results. From these, 69 studies reporting the incidence of LNI in relation to the impacted third molar extraction surgery were selected. After exclusion of 29 duplicates, 40 articles were examined. The subsequent

application of inclusion criteria led to the selection of 11 studies<sup>16,23-32</sup> and the exclusion of 29 studies<sup>5,14,33-59</sup> (► Fig. 1).

One of the excluded studies was a literature review by Pichler and Beirne in 2001.<sup>50</sup> This study was examined to potentially expand the selection of the articles included. However, of the eight results presented in that article, three duplicates were excluded, two studies<sup>60,61</sup> were excluded based on time criterion (prior to 1990), and the remaining three<sup>62-64</sup> were excluded based on selection criteria.

The results of the 11 selected items are summarized in ► Table 1. ► Table 2 reports the excluded articles and the reasons of their exclusion. The incidence of LNI in these studies was in a range of values between 0 and 8.94% for the temporary LNI and 0 and 1.60% for the permanent LNI.

To compare the results, the mean incidence values and standard deviations of LNI obtained by the studies were elaborated, distinguishing the sample treated with LF+



**Fig. 1** Flow chart of the inclusion/exclusion criteria: from a total of 480 results, only 11 articles were considered suitable for the review.

**Table 1** List of all the included studies with the year of publication and reported incidences (%) of temporary or permanent injuries to the inferior alveolar nerve related to the type of intervention (LF+/LF)

No.	First author	Year	Technique	Temporary LNI (%)	Permanent LNI (%)
1	Shad	2015	LF+	8.94	0
			LF	<b>2.63</b>	0.5
2	Jerjes	2010	LF	<b>1.8</b>	1.6
3	Jerjes	2006	LF	<b>6.5</b>	1
4	Pogrel	2004	LF+	1.6	0
5	Malden	2002	LF+	0.4	0
6	Gargallo-Albiol	2000	LF+	2.11	0
			LF	<b>0.63</b>	0
7	Robinson	1999	LF+	3.33	0
			LF	<b>0.9</b>	0
8	Appiah-Anane	1997	LF	<b>0.2</b>	0
9	Chiapasco	1996	LF+	0.05	0
10	Robinson	1996	LF+	6.9	0.8
			LF	<b>0.9</b>	0.3
11	Walters	1995	LF+	0.5	0

Abbreviations: LF, lingual flap; LNI, lingual nerve injury.

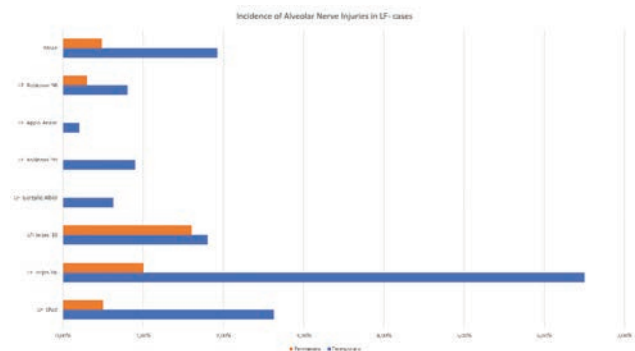
(3,886 surgeries) from that treated with LF (5,938 surgeries). The mean incidence of LNI of the cases treated with LF+ was  $2.98 \pm 0.03\%$  for the temporary injuries and  $0.1 \pm 0.003\%$  for the permanent ones (►Fig. 2). The mean incidence for the LF group was  $1.92 \pm 0.02\%$  for the temporary injuries and  $0.49 \pm 0.006\%$  for the permanent ones (►Fig. 3).

The overall incidence of injuries to the inferior alveolar nerve resulted to be higher for the LF+ cases.

## Discussion

The wide range of incidence values found in the articles (from 0 to 8.94%) could indicate a lack of homogeneity in the management of surgical protocols adopted by different authors.

The evaluation of the elaborated average values shows that the application of LF+ technique reduces the risk of both temporary and permanent lingual nerve damages. These average values are strongly influenced by the large case series produced by Jerjes et al<sup>24,25</sup> in the two studies taken into account in this review. These studies report an incidence of LNI after

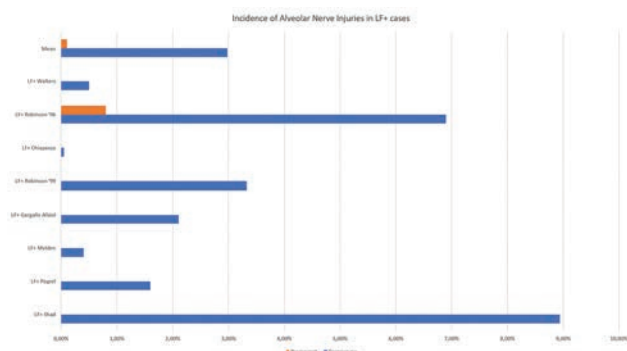
**Fig. 3** Incidence (%) of temporary and permanent injuries to the lingual nerve related to the lingual flap (LF) technique.

the application of a LF surgical protocol higher than the average incidence of the other studies in which surgeries were conducted with the same technique.

However, it must be pointed out that even without taking into account these data, the average of the values still indicates that the use of LF+ techniques reduces the incidence of permanent LNI in comparison with LF techniques, without increasing the incidence of temporary injuries.

Back in 1997, Appiah-Anane and Appiah-Anane published a study on 504 impacted wisdom teeth treated with LF+ technique. The only complication was transient paresthesia in one patient which settled within a month.<sup>30</sup>

In the prospective study published by Pogrel and Goldman in 2004, 250 patients were treated by LF+ method. There were four cases of transient lingual paresthesia, probably caused by traction pressure from the retractor. Three of these cases resolved within 3 weeks. The fourth case completely gained sensitivity within 2 months. There were no reported cases of permanent nerve damage.<sup>26</sup>

**Fig. 2** Incidence (%) of temporary and permanent injuries to the lingual nerve related to the lingual flap (LF+) technique.

**Table 2** List of the excluded articles and reasons that led to their exclusion

No.	First author	Year	Nonrandomized groups	Not standardized techniques	Less than 6 months of follow-up	Less than 200 third molars removed	Others
1	Mavrodi	2015	X	X			
2	Osunde	2014	X	X			
3	Yadav	2014	X				
4	Kale	2014				X	
5	Nguyen	2014		X			
6	Charan Babu	2013	X		X	X	
7	Smith	2013	X				
8	Guerrouani	2013		X			
9	Janakiraman	2010				X	
10	Cheung	2010	X	X			
11	Baqain	2010	X				
12	Akadiri	2009				X	
13	Gomes	2005				X	
14	Robert	2005					Insufficient data
15	Chossegros	2002					Only germectomy
16	Hägler	2002					Insufficient data
17	Renton	2001	X	X			
18	Bataineh	2001	X				
19	Gülicher	2001		X			
20	Ramadas	2001		X			
21	Pichler	2001					Study design not pertinent
22	Valmaseda-Castellón	2000	X				
23	Gülicher	2000		X			
24	Moss	1999		X			
25	Brann	1999		X			
26	Black	1997			X		
27	Greenwood	1994			X		
28	To	1994		X			
29	Schultze-Mosgau	1993		X			
30	Rood	1992	X	X			
31	Carmichael	1992	X	X			
32	Obiechina	1990		X			

The authors suggested that retention of the lingual plate gives optimum protection to the lingual nerve during the removal of impacted wisdom teeth.

These conclusions disagree with the quite common opinion that the surgical approach with only the buccal flap

preserves the integrity of the lingual nerve, more than the LF+ does.

It is evident that the main difficulty in drawing definitive conclusions derives from the large number of possibilities of intervention, and thus the high number of variables

almost impossible to be taken into account simultaneously.<sup>21</sup> Supporting this idea is the fact that even studies of similar design often report considerably different or totally opposed results, and this shows an unclear management of intervention variables that may represent a risk factor for LNI.

A possible factor leading to the spread of the theory, here refuted, according to which the application of the LF+ increases the risk of LNI, is related to the nonrandomization of the analyzed samples. In fact, it can be observed from the literature excluded from this review how, in most of the studies in which the LF+ was adopted on a selected and limited sample (on the basis of individual risk factors or other not specified factors), the incidence of the LNI increases if compared with the samples treated with LF. This result could easily depend on factors associated with sample selection, rather than the adopted surgical technique.

The analysis of the average values obtained from the selected literature would indicate a clear reduction of temporary and permanent LNIs with the use of LF+ techniques.

Among the promoters of the LF techniques, we can mention several authors but the most relevant study was conducted by Robinson and Smith in 1996. They suggested that LF technique has a reduced incidence of LNI in comparison with the LF+ technique.<sup>16</sup> The study by Robinson and Smith led to contrasting opinions and the debate arisen has not brought to clear and conclusive results yet: a possible explanation can be the excessive pressure made during the lingual flap protection obtained with the elevator.<sup>17–21</sup>

The results of the study by Robinson and Smith in 1996<sup>16</sup> is neither confirmed by the studies included here nor by the data that the same authors published few years later<sup>29</sup> and the second is that the LF+ cannot be considered a risk factor for permanent LNI.

## Conclusion

The results of this review suggest that the LF+ technique reduces the risk of lingual nerve damage during extraction of mandibular third molar. Moreover, the lingual flap retraction improves access to the site and can simplify the surgery.

Sometimes, there may be paresthesia, probably caused by traction pressure from the retractor, but the nature of damage is usually transitory and a complete healing is obtained in the following 2 to 6 months.

### Conflict of Interest

None declared.

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