

# Efficacy of Phentolamine Mesylate in the Reversal of Local Anesthesia

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## ABSTRACT

**Introduction:** The most frequently administered drugs in dentistry are local anesthetics which provide relief from pain during procedures leaving inconvenient residual numbness that takes some time to wear. Commencing Phentolamine Mesylate injection as a reversal local anesthesia (LA) acts as a boon for patients. The aim of this study was to determine if Phentolamine Mesylate accelerates return of normal soft tissue sensation based on duration of time and standard palpation measures.

**Methodology:** A total of 40 subjects were selected between age group of 6 to 12 years and divided into four groups according to the treatment required. Before local anesthetic administration, standard palpation and probing measures were performed. All four procedures were carried out and after about half an hour, Phentolamine Mesylate was injected in same amount i.e, 1:1. Treatment was resumed and completed in limited time. After completion of procedures, all the parameters were recorded again.

**Results:** Normal lip and tongue sensations and pain on probing appeared in all the subjects ranging between 72 to 87 minutes, which is more than half the time taken when Phentolamine Mesylate is not used.

**Conclusion:** Phentolamine Mesylate is a safe and an effective agent which can be used in pediatric patients for the reversal of residual soft tissue anesthesia so as to avoid self inflicting injuries and making its use universal for all the procedures.

## INTRODUCTION

With the continued improvements in local anesthetics

since the advent of procaine in 1905 (marketed as Novocaine), dental procedures can be performed virtually pain free. Post operative analgesics and anti-inflammatory medicines can also minimize the post operative discomfort that may be present after typical procedures are done in the dental office.<sup>1</sup>

Children, developmentally delayed teenagers, and cognitively impaired adult patients do not understand the dangers of chewing on the soft tissues subsequent to the use of topical or local anesthesia<sup>2</sup> (Figure 1a,b).

The at risk category includes the following:

- The patient with whom communication is not possible because of physical or mental health or cognitive understanding problems.
- The patient who is not aware of the dangers of biting or picking at the oral tissues after a topical or local anesthetic is used eg. children.

Prolonged soft tissue analgesia can be present for up to five hours after injection, while typical pulpal anesthesia lasts about an hour.<sup>1</sup> Many attempts have been made so as to minimize the duration of local anesthesia numbness.<sup>3</sup> The intraoral use of a medical procedure known as transcutaneous electrical nerve stimulation (TENS) in 1980s, experienced a brief period of popularity as a possible substitute for local anesthetics to provide operative pain control in dentistry<sup>4</sup> (Figure 2).

Phentolamine Mesylate, a novel drug and a product of Septodont USA (approved by FDA) is a local anesthesia reversal agent that brings back normal sensation and function so as to avoid the unwanted and unnecessary linge-



Figure 1a and b: Lip biting and scratchings on cheek.<sup>2</sup>



Figure 2: Transcutaneous electronic nerve stimulation (TENS).<sup>4</sup>

ring soft tissue anesthesia i.e., anesthesia of the lip and tongue, and their associated functions.<sup>5</sup> The present study

was conducted to determine if Phentolamine Mesylate accelerates return of normal soft tissue sensation based on duration of time and standard palpation measures.

## METHODS

The study was carried out in the Department of Pedodontics and Preventive Dentistry, in a Dental College. A total of 40 subjects were selected in age group of 6 to 12 years, who were scheduled to receive dental treatment in mandibular arch. Four groups were made as follows according to the treatment required:

Group 1- Retained teeth extraction

Group 2- Single visit pulpectomies

Group 3- Single visit root canal treatments (RCT)

Group 4- Stainless steel crown restorations (SSC)

The selection was done irrespective of sex and socio-economic status. The criteria of selection were systemically healthy subjects with no history of antibiotic therapy within previous three months, no systemic disease, and no chronically infected tooth.

**Procedure:** Before starting the procedure i.e. before local anesthetic administration, standard palpation and probing measures were performed. After that the routine techniques and methods were used in performing all the four procedures. All the procedures were planned for single visit and were limited to a maximum of one hour duration at chair side.

About half an hour after the local anesthetic was administered, Phentolamine Mesylate (Oraverse) 0.4 mg, packaged in a 1.7 ml dental cartridge was administered to the patient in the same location (previous needle prick mark at the time of local anesthetic administration) (Figure 3 a,b), with the same method and in the same amount of 1:1 ratio. Thereafter, the dental treatment procedure was resumed and completed in limited time. Patient alongwith the guardian was allowed to sit in the Department of Pedodontics and Preventive Dentistry until normal lip and tongue sensations and pain on probing had come back. Meanwhile after the treatment, the routine follow up medications were started straightway (including NSAIDS) if they were required.

All the previously noted parameters were again recorded for evaluation at following intervals during the procedure using a chart which was assigned for each patient:

- After local anesthetic administration

- After study drug Phentolamine Mesylate administration
- Every 30 succeeding minutes till the time of recovery of normal lip and tongue sensation was achieved.



**Figure 3a: Needle prick mark by local anesthetic injection.**



**Figure 3b: Phentolamine Mesylate administration at same site as that of local anesthesia.**

### **RESULTS**

The study was conducted on 40 subjects of 6-12 years of age, who were scheduled to receive dental treatment in mandibular arch. Retained teeth extraction, single visit pulpectomies, single visit root canal treatments (RCT) and stainless steel crown restorations (SSC) were performed on 10 subjects each, respectively. On comparison, time to return from lip numbness, tongue numbness, and pain on probing were minimum for RCT with mean of 72 minutes and maximum for extraction with mean of 87 minutes.

When Phentolamine Mesylate was administered about half hour after the local anesthetic in each procedure i.e. RCT, pulpectomy, SSC and extraction with the same method and same amount i.e. 1:1 ratio, normal sensation returned within 9 to 16 minutes which is comparatively fast. Otherwise, normal lip and tongue sensations and pain on probing appear in 72 to 87 minutes, which is more than half the time taken when Phentolamine Mesylate is not used (Table 1).

### **DISCUSSION**

The proposed mechanism of action of Phentolamine Mesylate which is a vasodilator, with respect to local anesthesia reversal is that increased local blood flow accelerates the clearance of local anesthetic from the sub mucosal tissue to the bloodstream.<sup>6</sup> Some data demonstrated that when Phentolamine Mesylate injections are administered in adults after lidocaine injections, the maximum plasma concentration of lidocaine increases, a finding consistent with the proposed mechanism.<sup>7</sup>

The findings of Phentolamine Mesylate in subjects aged 4 to 11 years were similar to those of the adult. Normal lip sensation returned approximately 75 minutes faster compared with sham injection ( $p < 0.0001$ ). The local anesthetic blood level was not affected by the injection of Phentolamine in the study population.

In the present study, 2% Lignocaine in 1:100,000 adrenaline was used for inferior alveolar nerve blocks and thereafter Phentolamine Mesylate was administered in 1:1 volume at the same site and with the same technique. The return of normal sensations occurred ranging between 72 to 87 minutes after administering Phentolamine Mesylate, which is much faster than the usual time.

The volume of phentolamine and local anesthetic administered should be equal which was based on the assumption that phentolamine blocks the injected vasoconstrictor.<sup>8</sup> Otherwise the mechanism is that phentolamine blocks the actions of released norepinephrine and increases local blood flow. This conclusion is based on studies stating that sub mucosal epinephrine is quickly absorbed and gone by the time phentolamine is injected.<sup>9,10</sup>

Also the pharmacokinetic data indicating that phentolamine increases the systemic absorption of local anesthetic remaining in tissues at the time of injection.<sup>7</sup> Accepting this mechanism as correct, one dose of

**Table 1: Comparison of procedures on selected variables**

Procedure	Lip numbness, Tongue numbness, Pain on probing			
	n	Mean	SD	ANOVA f 'p' Value
RCT	10	72	15.4	2.04 0.124
Pulpectomy	10	78	15.4	
SC	10	75	15.8	
Extraction	10	87	9.4	

phentolamine per local anesthetic injection site regardless of the number of local anesthetic cartridges was used here. Following this strategy would reduce the amount of phentolamine used and allow more local anesthetic injections to be reversed without exceeding the maximum recommended dose of two cartridges. The proposed mechanism also suggests that local anesthetics without vasoconstrictors should be effectively reversed by phentolamine.

The official prescribing information calls for phentolamine to be injected “following the dental procedure”. A better strategy may be to administer phentolamine earlier in the appointment when strong local anesthesia is no longer required. For an operative procedure, this time would generally be when the tooth preparation is finished but before the restorative material has been placed.<sup>8</sup>

In the present study, unlike in the previous studies Phentolamine Mesylate in the mid way of the dental procedure (i.e. 30 minutes after the start of the procedure) was administered, so that the usually painful and operative procedure was already over by then. Thereafter, with regard to different procedures also i.e. retained teeth extractions, pulpectomies, root canal treatments, and stainless steel crowns, no significant difference was seen in the activity of Phentolamine Mesylate.

**CONCLUSION**

Phentolamine Mesylate brings dramatic change in dentistry making patients free from the unwanted and unnecessary numb sensation which is normally experienced after dental procedures.

Use of Phentolamine Mesylate in children reduce their tendency to chew their tongue, cheeks and/or lips when those areas are numb, and there is less likely to be a problem because the anesthetized area is more quickly

returned to normal. Phentolamine Mesylate a novel drug is a local anesthesia reversal agent that brings back normal sensation and function earlier and therefore the side effects can be avoided.

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