

# Trapezius squeeze test versus jaw thrust to assess the depth of anaesthesia for proseal laryngeal mask airway insertion in children

## Abstract

**Background:** “Trapezius squeeze test” (TST) is a simple test to perform in which 1–2 inches of trapezius muscle is held and squeezed in full thickness and response is evaluated in the form of toe/body movement. We compared the effectiveness of the trapezius squeeze test (TST) with the Jaw thrust (JT) as clinical indicators for optimal anaesthesia depth for Proseal laryngeal mask airway (PLMA) insertion in spontaneously breathing children under sevoflurane anaesthesia.

**Materials and methods:** 60 children between 2 to 8 years of age, weighing 10 to 20 kg, of ASA physical status I & II undergoing minor surgical procedures were randomly allocated to the group T (TST, n=30) and the group J (JT, n=30). Anaesthesia was induced using 4% sevoflurane in O<sub>2</sub>. As the child lost the eyelash reflex, TST or JT was performed in respective group & repeated every 15 sec till it became negative. When it became negative, a well lubricated size 2 PLMA was inserted. Insertion time of PLMA; end-tidal and MAC value of sevoflurane at the time of PLMA insertion; ease of PLMA insertion and complications as well as hemodynamic parameters were recorded.

**Results:** In Group T, Mean time for TST to become negative was 4.48±0.6 minutes and insertion condition was excellent in 30 patients (100%) compared to 4.85±0.71 minutes and excellent condition in 27 patients (90%) in group J. In group T, PLMA was successfully inserted in 1st attempt in 100 % while in 97% in group J. coughing was observed in 2 patients in group J.

**Conclusion:** Trapezius squeeze test provides excellent conditions and higher success rate of PLMA insertion in spontaneously breathing children without any untoward effects and can be used as an alternative to jaw thrust manoeuvre.

**Keywords:** Proseal laryngeal mask airway, Children, Sevoflurane anaesthesia

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**Abbreviations:** LMA, Laryngeal Mask Airway; ASA, American Society of Anaesthesiologist; TST, Trapezius Squeeze Test; PLMA, Proseal Laryngeal Mask Airway; MAC, Minimum Alveolar Concentration; SAD, Supraglottic Airway Device; JT, Jaw Thrust

## Introduction

PLMA in paediatric patients is a benchmark second generation of supraglottic airway device (SAD), with established record of safety and efficacy.<sup>1</sup> Successful insertion of PLMA requires adequate depth of anaesthesia. LMA if inserted under lighter planes of anaesthesia can result in coughing, gagging, body movements, breath holding, and even rejection of LMA.<sup>2</sup> The indicators which are used to measure the depth should give precise information about anaesthetic depth to avoid complications owing to deep or light anaesthesia, and it should be a simple, repeatable, and easy to perform. Several such indicators are loss of verbal contact and eyelash reflex, acceptance of anaesthesia mask, ease of manual ventilation, loss of ability to hold the light object and jaw relaxation.<sup>3–5</sup> But these tests are abolished at lighter plane of anaesthesia. Trapezius squeeze test (TST) and Jaw thrust (JT) are abolished at deeper plane of anaesthesia.<sup>5,6</sup> Jaw thrust is the only clinical marker shown to be reliable in adults [5] but not tested in children for the same purpose. “Trapezius squeeze test” (TST) is a clinical test, simple to perform in which 1-2 inches of full thickness trapezius muscle is held and squeezed for 1-2 seconds and response evaluated in the form of toe/body movement.<sup>7</sup> Thickness of trapezius

muscle varies according to age. Although used extensively for grading consciousness, this test has rarely been used as an indicator of adequate depth of anaesthesia for LMA insertion. Therefore; we evaluated the efficacy of negative TST or jaw thrust as an indicator for optimal anaesthesia depth for uncomplicated PLMA insertion in spontaneously breathing children under sevoflurane anaesthesia.

## Materials and methods

After ethical committee approval, a prospective, randomised, single blind study comprised of 60 children between 2 to 8 years of either genders weighing 10-20 kg of ASA grade I/II, undergoing planned lower abdominal surgery like congenital hernia/hydrocele repair, orchidopexy, circumcision, etc. was conducted. Children with delayed development, recent URTI, previous /anticipated difficult airway, restricted mouth opening, and h/o regurgitation, pathology of oropharynx, neck & upper GIT were excluded from the study. The children were randomly allocated into two groups of 30, group T and Group J, each using an envelope method. After explaining the procedure and the method of anaesthesia to be administered, written informed consent was obtained from the parents.

As the patient arrived in the operation theatre, the compact airway module of Datex-Ohmeda S/5 or Dragger Fabius Anaesthesia machine was readied to measure sevoflurane concentration (end-tidal and MAC), EtCO<sub>2</sub>, SpO<sub>2</sub>, pulse rate and NIBP. Baseline vitals

were recorded. Inj. Glycopyrrolate 5µg/kg was given intravenously before induction. General anaesthesia was induced by an experienced anesthesiologist via a face mask with Jackson Rees circuit primed with 4% sevoflurane and oxygen with 4 liter/min fresh gas flow. Spontaneous ventilation was first to be assisted and then if required, controlled manually. As soon as the child lost his/her eyelash reflex, the TST/ jaw thrust were performed according to group (Figure 1). Performance of the tests and PLMA insertion will be done by the same anesthesiologist throughout the study. Either of the tests was repeated every 15 sec till it became negative. When child lost response to test, a well lubricated, PLMA No. 2 was inserted with the standard digital technique and cuff was inflated with 10ml air. Effective ventilation was determined by observing chest wall movement, auscultation over chest, absence of gastric insufflation by auscultation over epigastrium, capnography and passing of Ryle's tube (No. 10) easily through drain tube.

If the attempt failed, patient was ventilated again with 4% sevoflurane and oxygen at 4 L/min till the TST or jaw thrust became negative and second attempt was tried. Inj. Fentanyl 1 mcg/kg IV was given for intraoperative analgesia. The end point of the study was establishment of effective ventilation. The insertion time was measured from the time when sevoflurane administration started to the negative TST or jaw thrust. At that time, the end-tidal and MAC value of sevoflurane concentration was also recorded. Ease of insertion was judged on a three point scale as excellent, acceptable, and unacceptable.<sup>8</sup>

**Grade 1** - Excellent - No resistance

**Grade 2** - Acceptable - with some difficulty and some resistance

**Grade 3** - Unacceptable -Impossible to insert



**Figure 1** Trapezius Squeeze test.

Numbers of attempts during PLMA insertion and any complications such as coughing, gagging, laryngospasm, breath holding, or body movement at the time of PLMA insertion were noted. Hemodynamic parameters such as heart rate, blood pressure, SpO<sub>2</sub> and EtCO<sub>2</sub> were recorded at the time of induction of anaesthesia, immediately after insertion of PLMA and then 5 min after the PLMA placement.

Assuming  $\alpha$  error 0.05 and  $\beta$  error 0.2, when sample size was calculated from the pilot study, it worked out to be 30 patients per group. Data were presented in mean±SD. They will be compared using student t-test and chi square test to find difference in results between two groups and statistical analysis performed using MedcalC software version 14.8.1.

## Results

Demographic data were comparable in both the groups (Table 1). The selection of the surgeries created male predominance in our study.

Majority children were posted for congenital herniotomy (Table 2). Insertion time in group T and group J was comparable (4.48±0.6 v/s 4.85±0.71 minutes P>0.05). The end-tidal (3.72±0.2 v/s 3.7±0.13, >0.05) concentration and MAC (1.74±0.09 v/s 1.72±0.1, >0.05) of sevoflurane in both the groups were similar. PLMA was inserted in 1st attempt in all cases in group T while 3% cases required 2nd attempt in group J (Table 3). Excellent insertion condition was found in all cases in group T while it was excellent in 90% and acceptable in 10% cases in group J (Table 4). No complication except coughing was found in 2 (7%) cases in group J. All children remained hemodynamically stable during the procedure (Chart 1).

**Table 1** Demographic data

	Group-T	Group-J	p-value	
Age (Years)	4.24±1.59	5±1.44	>0.05	
Weight (Kg)	13.22±2.29	13.94±2.22	>0.05	
Gender	Male	27 (90%)	26 (87%)	>0.05
	Female	3 (10%)	4 (13%)	>0.05
Duration of surgery (minutes)	46±13.07	43.8±14.53	>0.05	

**Table 2** Type of surgeries

Type of Surgery	Group-T	Group-J
Congenital herniotomy	12 (40%)	16 (53%)
Circumcision	8 (27%)	5 (17%)
Orchidopexy	10 (33%)	9 (30%)

**Table 3** Induction and insertion

	Group-T	Group-J	p value	
Insertion Time (minutes)	4.48±0.6	4.85±0.71	>0.05	
End-tidal sevoflurane concentration at the time of LMA insertion (%)	3.72±0.2	3.7±0.13	>0.05	
MAC value of sevoflurane at the time of LMA insertion	1.74±0.09	1.72±0.1	>0.05	
Attempts of LMA insertion	1	30 (100%)	29 (97%)	>0.05
	2	0	1 (3%)	

**Table 4** Grading of insertion conditions

	Group-T	Group-J	p value
Excellent	30 (100%)	27 (90%)	>0.05
Acceptable	0	3 (10%)	
Unacceptable	0	0	

## Discussion

LMA insertion without a neuromuscular blocking agent requires an anaesthetic depth sufficient enough to obtund the airway reflexes. In a previous study, apnoea, jaw relaxation, loss of verbal contact and eye lash reflex were suggested as clinical markers for LMA insertion. However, these methods had a high incidence of complications like coughing, gagging, hiccups, aspiration and second trials.<sup>9</sup> Priya et al.<sup>10</sup> used jaw relaxation as the end point to insert LMA in adults but found excellent condition only in 32% cases while using sevoflurane. O'Neill et al.<sup>11</sup> used jaw relaxation and evidence of stage III surgical anaesthesia, such as verified eye position and ventilation pattern in children, to determine the level of anaesthesia sufficient for LMA insertion. In their study, the success rate of LMA insertion on the first attempt was 91%, but the incidence of laryngospasm and hypoxia was 1.7% and 6.6%, respectively. Lopez-Gil et al.<sup>12</sup> reported that the success rate of the first attempt for LMA insertion in children was 91% using loss of eyelash reflex, jaw relaxation, and absence of movement, but

they did not mention complications. Corneal reflex has been compared to trapezius reflex and is graded as stimulus of almost same intensity and essentially defines the same depth of anaesthesia.<sup>4</sup> Jaw thrust is considered to imitate the stretch induced stimulus that is caused by insertion of LMA. Loss of response to trapezius muscle and jaw thrust are graded as intense noxious stimulus but having the lesser intensity than that of surgical incision, laryngoscopy, and intubation.<sup>6</sup> Drage et al.<sup>5</sup> compared loss of verbal contact with jaw thrust manoeuvres for LMA insertion in adults and reported a jaw thrust as an adequate clinical indicator to assess the depth of anaesthesia for LMA insertion with 87% success rate, which was similar to even study done by Townsend et al.<sup>13</sup> (94%) but success rate was found lower in the study done by Chang et al.<sup>14</sup> (72%). Conditions were reported to be optimal when jaw thrust was used as an end point of insertion even by Krishnappa and Kundra.<sup>15</sup> The bispectral index (BIS) is a useful measure for monitoring depth of anaesthesia. However, the BIS cannot predict motor responses to noxious stimuli mediated by subcortical structures because it monitors only cortical function. Cortical activity does not accurately predict motor response to noxious stimulation. Cortical and sub cortical components are independent of each other.<sup>16</sup> Several studies have determined the endtidal concentration of volatile anaesthetics needed to achieve adequate anaesthetic depth for LMA insertion. However, blood concentrations depend on multiple factors, including age, gender, body weight, dose and cardiac output.<sup>17,18</sup>

in group J which was longer than observed by Chang et al.<sup>14</sup> in adults (2.1±1.1minutes) which may be because he used 8% of sevoflurane for induction. We used an inspired sevoflurane concentration of 4% instead of 8% to increase the end-tidal sevoflurane concentration more slowly for detection of the precise timing of trapezius reflex or jaw thrust reflex disappearance. The end-tidal sevoflurane concentration in our study was similar in both the groups (3.72±0.2 vol% / 3.7±0.13vol%) which is comparable to study done by Hooda et al.<sup>4</sup> & Chang et al.<sup>7</sup> where as it was higher (4.1vol%)in adults as observed by Chang et al.<sup>14</sup>

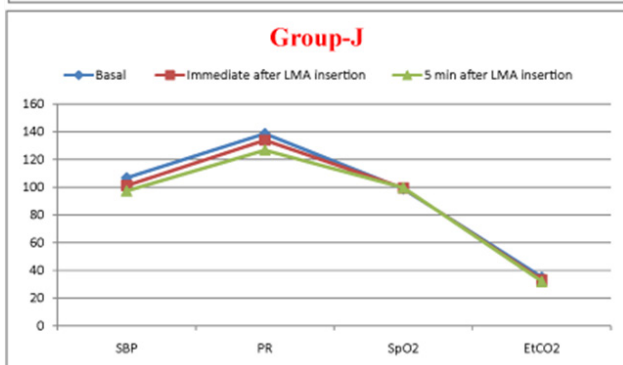
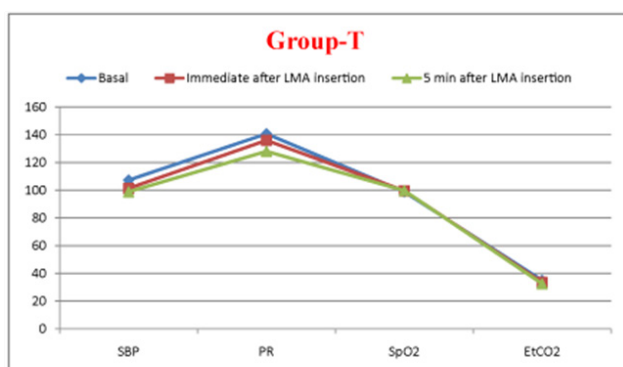


Chart 1 Changes in hemodynamic.

Not a single study is available comparing the TST and jaw thrust for assessment of depth of anaesthesia for LMA insertion in children. Chang et al.<sup>14</sup> in adult population compared both the tests and found similar insertion time required in group T (4.1±1.8) as in our study. We found successful PLMA insertion in maximum number of patients between 4-5 minutes in group T while it was 5-6 minutes in group J (15 v/s 14) (Chart 2 and 3). The elapsed time from anesthetic induction to LMA insertion was 4.48±0.6 in group T which was also comparable with the study done by Hooda et al.<sup>4</sup> in children and but it was reported to be longer by Chang et al.<sup>7</sup> (4-10minutes). It took 4.85±0.71 minutes

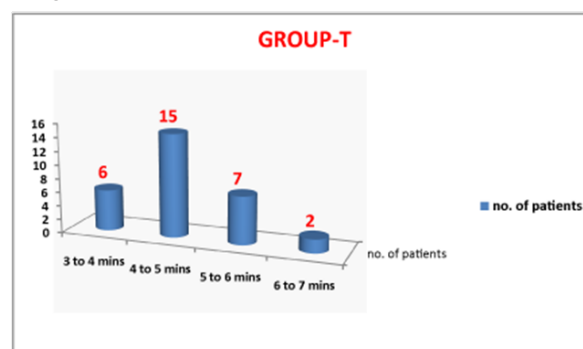


Chart 2 Insertion time in Group T.

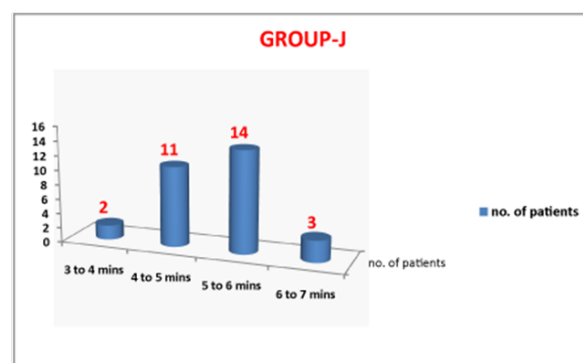


Chart 3 Insertion time in Group J.

Successful insertion of PLMA was possible in 1st attempt 100% in group T while 3% children required 2nd attempt in group J and the insertion condition was excellent in 100% in group T and 90% in group J. Hooda et al.<sup>4</sup> found excellent condition in 91% cases using trapezius squeeze as an indicator. Entropy would have been a clinically relevant alternative for more accurate assessment of the depth of anaesthesia in unparalyzed patients but due to nonavailability, we could not use it. We did not find any complications except coughing in 2 (7%) cases in group J. These patients did not require any additional medication. We did not find ecchymosis at the squeeze site in any single case in group T. There were no hemodynamic changes observed in either pulse, systolic blood pressure, SaO<sub>2</sub> or EtCO<sub>2</sub> in any single case in both the groups.

Thus, both the tests can be used as an indicator of depth of anaesthesia to insert PLMA in children as both are repeatable, easily applicable, harmless and provide satisfactory conditions for PLMA insertion. TST is a good alternative which provides more consistent information with higher rate of successful insertion in unparalyzed children in absence of modified monitoring device like entropy.

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## Conflicts of interests

Authors declare that there is no conflict of interest.

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