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The reinforced laryngeal mask in dental day surgery

A P L Goodwin[1], T W Ogg[2], W T Lamb[2] and D M Adlam[2]

[1]Nuffield Department of Anaesthetics, John Radcliffe Hospital, Oxford; [2]Addenbrooke's Hospital, Cambridge, UK

Sixty adult patients undergoing removal of third molars under general anaesthetic in the Cambridge day surgery unit were randomly allocated to receive either a conventional anaesthetic employing nasotracheal intubation (NETT), pharyngeal gauze pack and inhalation agents or the reinforced laryngeal mask airway (RLMA) and total intravenous anaesthesia. Thirty patients were studied in each group. Immediate recovery times were significantly longer in the NETT group ($P = 0.01$). Surgical access was adequate in both groups. Postoperative muscle pains were significantly less in the reinforced laryngeal mask airway (RLMA) group ($P = 0.0001$). The RLMA provides a reliable method of airway management during removal of impacted third molars, with a reduction in postoperative morbidity when compared with conventional nasotracheal intubation involving the use of suxamethonium.

Key words: Reinforced laryngeal mask airway, day surgery, oral surgery

The aim of the present study was to investigate the use of the reinforced laryngeal mask airway (RLMA) in patients undergoing removal of impacted third molar teeth under general anaesthesia, with particular reference to intra- and postoperative morbidity.

The use of nasal endotracheal intubation is popular for intermediate and major oral surgery. At Ohio State University 5223 day patients underwent tracheal intubation with few serious complications. However there was a considerable morbidity, e.g. sore throat and suxamethonium afterpains[1]. Non-depolarizing muscle relaxants presently available may not be suitable for rapid day care procedures.

With the introduction of the Brain laryngeal mask airway[2,3] many day surgical procedures do not require endotracheal intubation. Recently a reinforced latex model of the laryngeal mask airway (Figure 1) has been manufactured. A pilot study indicated that the RLMA could be used during the extraction of wisdom teeth without significant problems. Muscle relaxants were not used for endotracheal intubation and no oropharyngeal gauze pack was inserted.

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Correspondence and reprint requests to: Dr A P L Goodwin, Nuffield Department of Anaesthetics, John Radcliffe Hospital, Oxford, UK

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Method

The study had District Ethical Committee approval. Sixty adults (American Society of Anesthesiologists (ASA) classification I or II) undergoing the removal of third molar teeth under general anaesthesia in the day surgery unit were recruited into this prospective, randomized, parallel group study. All gave written informed consent. Their ages ranged from 16–50 years and their weights were within 15% of their ideal body weight. Exclusion criteria included a known history of chronic alcohol or drug abuse, pregnant or lactating females and any patient who had received a regular course of medication during the four weeks prior to surgery.

Patients were randomly allocated into two anaesthetic groups. Group A received a modified total intravenous technique with the reinforced laryngeal mask airway. Group B received a conventional inhalational anaesthetic involving nasotracheal intubation.

Prior to induction of anaesthesia critical flicker frequency (CFF) thresholds were measured using the Leeds flicker fusion tester. All anaesthetics were administered by the authors. Both groups received a standard anaesthetic induction with propofol 2.5 mg kg^{-1} (with 10 mg lignocaine in each 200 mg propofol) and alfentanil 4 μg kg^{-1}. Following induction, group A had an RLMA positioned and spontaneously breathed 33% oxygen in nitrous oxide via a parallel Lack system. Further boluses of alfentanil were given as deemed clinically necessary. An infusion of propofol at 10 mg kg^{-1} h^{-1} was delivered via an intravenous cannula using the Ohmeda 9000 infu-

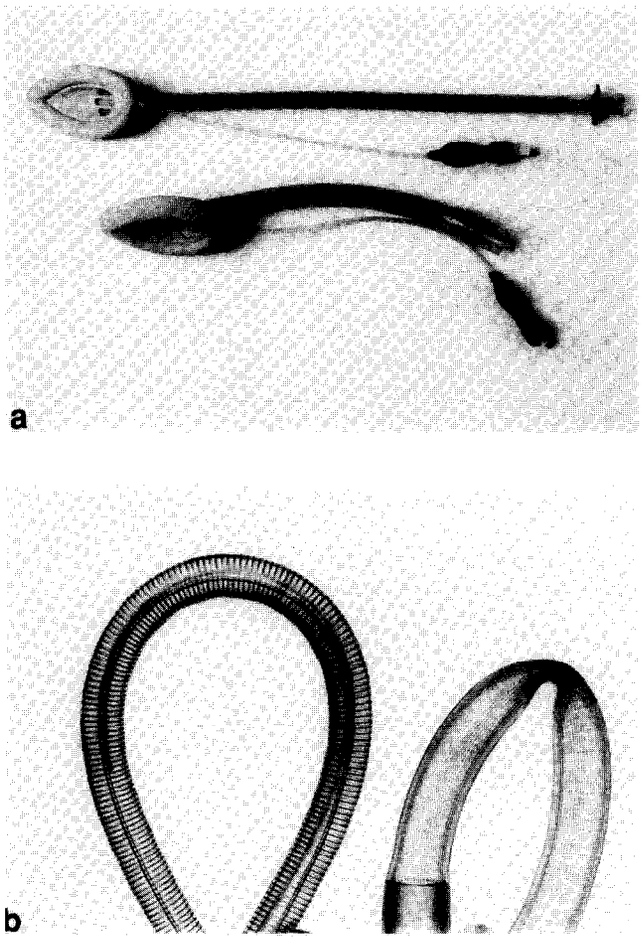

Figure 1. The conventional and reinforced (top in **a**; left in **b**) laryngeal mask airway.

Table 1. Mean (SD) age and weight of patients and number of teeth removed together with sex ratio for the RLMA and NETT groups

	RLMA	*NETT*
Age	23.95 (5.28)	24.9 (5.49)
Weight (kg)	63.35 (10.54)	63.51 (10.3)
Sex ratio male:female	6 : 24	6 : 24
Number of third molars removed	3.23 (0.971)	3.267 (0.98)

Table 2. Mean (SD) doses of propofol, alfentanil and suxamethonium, duration of anaesthesia and surgery and immediate recovery times for the RLMA and NETT groups

	RLMA	*NETT*
Propofol induction (mg)	175.33 (30.25)	174.33 (30.59)
Propofol maintenance (mg)	253.4 (92.27)	0
Total alfentanil (μg)	649.16 (164.8)	260.83 (70)
Suxamethonium (mg)	0	65.3 (16.91)
Duration of anaesthesia (min)	19.8 (5.66)	20.36 (7.35)
Duration of surgery (min)	15.9 (5.47)	16.33 (7.68)
Immediate recovery time (min)	6 (3.12)	8.16 (3.2)*

*$P = 0.0105$

sion pump (Ohmeda, UK). Further bolus doses of propofol were given to maintain a necessary level of anaesthesia. Following the standard induction, group B were given suxamethonium 1 mg kg^{-1} to facilitate nasotracheal intubation with an appropriate-sized red rubber uncuffed endotracheal tube. The oropharynx was packed with a moist, green gauze pack. Patients breathed 33% oxygen in nitrous oxide supplemented with enflurane 2–3%.

Airway difficulties encountered using both techniques were monitored. The pulse, indirect systolic and diastolic blood pressure, end-tidal carbon dioxide concentration, respiratory rate, oxygen saturation and inspired oxygen concentration were measured throughout the procedure. Following surgery, patients were transferred to a recovery room in the lateral recovery position. Patients breathed oxygen enriched air until they awoke. Awakening was defined as the time at which a Steward score (4) of 6 was first obtained. The immediate recovery time, i.e. the time from cessation of anaesthesia to awakening, was also recorded. Following removal, the RLMA was inspected for evidence of aspiration of stomach contents or leakage of blood from above.

Patients were invited to complete visual analogue scores (100 mm) for pain, nausea and headache at 30, 60, 90 and 120 minutes after a Steward score of 6 had been obtained. Critical flicker frequency thresholds were measured preoperatively and then at 60 and 120 minutes after immediate recovery. Analgesia was prescribed in the postoperative period as required.

On discharge patients were given a questionnaire to assess postoperative morbidity. This was completed after 48 hours and the questionnaire returned in the stamped addressed envelope provided. Data was analysed using *t*-test, multiple analysis of variance (MANOVA) and Wilcoxon signed rank test. Significance was considered to occur at $P < 0.05$.

Results

Sixty patients were studied (30 in each group). Table 1 shows the mean (SD) values for age, weight, sex ratio and number of molars removed. There were no differences in demographic data between the two groups. Table 2 outlines the mean (SD) doses of propofol, alfentanil and suxamethonium administered, duration of surgery and anaesthesia, and immediate recovery time. Immediate recovery time (time from cessation of anaesthesia to achieving a Steward score of 6) was significantly longer in the NETT group ($P = 0.0105$). There were no differences in cardiovascular parameters throughout the operative period. There were no differences in respiratory parameters throughout the operative period.

Problems with positioning the nasotracheal tube were

Table 3. Mean (SD) differences between pre- and post-operative critical flicker fusion thresholds (Hz) at 60 and 120 min post Steward score of 6

Flicker fusion frequency (Hz)	*RLMA*	*NETT*
Pre-op minus 60 mins	−0.436 (2.05)	−0.82 (2.03)
Pre-op minus 120 mins	−0.22 (2.93)	−0.48 (3.51)

Table 4. Median (range) visual analogue scores (mm) for pain, nausea and headache in the first two postoperative hours in the RLMA and NETT groups

*Time**	*RLMA*	*NETT*
Pain		
30 mins	41 (0–100)	48 (2–100)
60 mins	31 (0–80)	31 (2–93)
90 mins	24 (0–76)	25 (0–100)
120 mins	20.5 (0–77)	20 (0–81)
Nausea		
30 mins	0 (0–34)	0 (0–68)
60 mins	0 (0–28)	0 (0–57)
90 mins	0 (0–31)	0 (0–56)
120 mins	0 (0–28)	0 (0–47)
Headache		
30 mins	0 (0–87)	12 (0–78)
60 mins	1 (0–63)	9 (0–63)
90 mins	0 (0–48)	2 (0–72)
120 mins	0 (0–46)	1 (0–72)

*After Steward score of 6

encountered in seven patients. Problems included haemorrhage, difficulty in placing the nasotracheal tube in the trachea, as defined by more than one assistance with Magills forceps or a positional manoeuvre such as cricoid pressure or cervical flexion. In four patients the position of the RLMA was unstable needing repositioning. No patient showed any reduction in peripheral oxygen saturation during these difficulties. Surgical access was adequate in all patients in this study.

On inspection of the RLMA, following removal, there was no evidence of aspiration of stomach contents or leakage of blood from above. Postoperative laryngeal spasm was encountered in one patient in the nasotracheal group. No other postoperative airway problems occurred. Table 3 shows the mean (SD) differences between pre- and postoperative critical flicker fusion thresholds at 60 and 120 minutes post Steward score of 6. There were no significant differences within or between groups. Table 4 shows the median (range) visual analogue scores for pain, nausea and headache. There were no significant differences between the two groups.

Fifty-seven of the 60 patients returned the postoperative questionnaire (95%). Figure 2 shows the median (interquartile range) visual analogue scores for headache, sore throat, nausea, muscle pains, dizziness, drowsiness and oral pain in the first 48 postoperative hours. There were significantly less muscle pains in the RLMA group ($P = 0.0001$) in the first 48 postoperative hours. There were no other significant differences.

Postoperatively all patients considered that they had been given adequate information and instructions regarding their treatment in the day surgery unit. Two patients required the services of their general practitioner in the first 48 postoperative hours, both required further analgesia for oral pain. Three patients returned to hospital for treatment. Two in the RLMA group for pain and one in the NETT group for assessment of severe chest and shoulder pain, probably resulting from suxamethonium myalgia. The patient was reassured, given simple analgesics and advised to rest. Three patients were admitted postoperatively from the day surgery unit due to excessive bleeding. All three were in the nasotracheal tube group.

Discussion

Conventional anaesthetic practice for oral surgery involves nasotracheal intubation and the insertion of a pharyngeal gauze pack, thereby ensuring airway protection with a suitable operative field[5,6]. Muscle relaxants are usually required for intubation, but they have been omitted with varying success[7,8]. A higher postoperative morbidity for day-case dental surgery was reported in a group of patients paralysed with alcuronium and ventilated, when compared to a similar group receiving suxamethonium and breathing spontaneously[9]. Newer non-depolarizing muscle relaxants may reduce morbidity, but with short surgical procedures the need for adequate reversal and return of airway reflexes prior to extubation may reduce the number of cases performed on a day surgery dental list. It has been suggested that the duration of paralysis is a factor associated with postoperative morbidity[10]. Suxamethonium is commonly used for intubation of patients for short outpatient procedures[11], despite the fact that it induces muscle pains. Recently these have been reported to occur in between 41 and 63% of non-pretreated outpatients[12–14]. Pretreatment with non-depolarizing muscle relaxants decreases the incidence of post-suxamethonium myalgia, but does not abolish it[15,16]. Furthermore the incidence of postoperative myalgias may be unrelated to the use of suxamethonium[17], this study would support this. Postoperative myalgias occurred in the RLMA group.

The laryngeal mask airway provides a method of airway management without recourse to muscle relaxants. The laryngeal mask airway can protect the airway from contamination as demonstrated by the non-leaking of methylene blue placed in the pharynxes of 64 patients undergoing anaesthesia with the laryngeal mask[18]. Close fibreoptic inspection supported this finding and there is no doubt that the RLMA may be safely used for nasal operations[19]. Aspiration of blood is less likely than with dye since it is more viscous and tends to clot. Contamination of the lower airway did not pose a clinical problem in the present study. This has since been confirmed in this group of patients by fibreoptic examination of the tra-

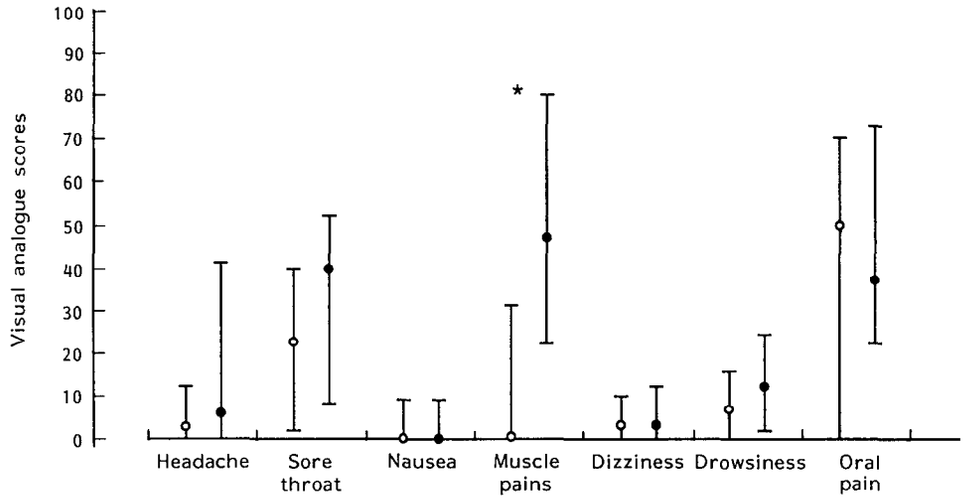

Figure 2. Median (interquartile range) visual analogue scores (mm) in the nasal endotracheal tube (NETT) and reinforced laryngeal mask airway (RLMA) groups for headache, sore throat, nausea, muscle pains, dizziness, drowsiness and oral pain in the first 48 post-operative hours. ● NETT = nasoendotracheal tube; ○ RLMA = reinforced laryngeal mask airway; $^*P = 0.0001$.

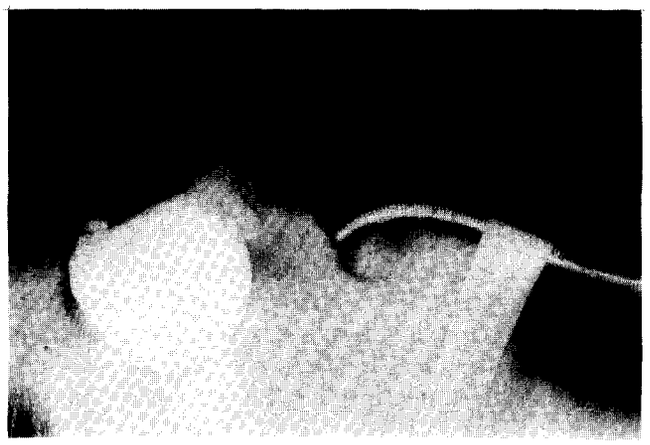

Figure 3. The reinforced laryngeal mask in place.

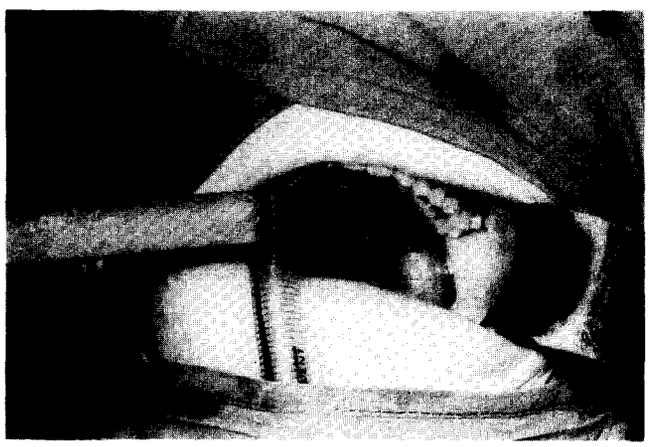

Figure 4. The surgical field.

chea prior to removal of the RLMA (P Davies, personal communication).

The laryngeal mask airway also provides an alternative to conventional nasal mask anaesthesia in paediatric dental outpatient anaesthesia, with superior oxygenation and no difficulty with surgical access, extraction or haemorrhage[20]. The prototype RLMA consists of a standard mask sealed to an armoured narrow bore tube of 10 mm internal diameter and 19 cm length. The tube, in this study, was secured to the lower mandible with tape (Figure 3) which allowed movement from side to side when dental retractors were used. No airway deterioration occurred with movement and the oral surgeons reported adequate surgical fields with the RLMA in situ (Figure 4). A degree of RLMA rotation occurred in four patients, a situation easily rectified by repositioning. These patients were female and a size 3 RLMA was used, but it has been suggested that the size 3 may be too small for females on occasion (Dr A J Brain, personal communication). Perhaps the use of a size 4 in these patients might have abolished any degree of rotation. Interestingly all four patients salivated excessively and this could have potentiated the problem. In the NETT group, difficulties were encountered with seven intubations. All were successfully intubated and only one patient in this group developed postoperative laryngeal spasm treated with oxygen, suction and head down tilt. No episodes of peripheral oxygen desaturation occurred in any of these patients.

Previous studies have shown that postoperative sore throats may be reduced if patients are not intubated[21]. This study has shown that the incidence of sore throat following the insertion of the RLMA was not significantly different when compared with nasal tracheal intubation. Suxamethonium has also been implicated with postoperative sore throats[22] but this was not confirmed by this study.

Finally we believe that the results from our study indicate that the use of the RLMA provides a suitable alternative for dental day-case anaesthesia. In associa-

tion with a total intravenous anaesthetic technique and no suxamethonium there was significantly less postoperative myalgia. It is conceded that postoperative dental pain remains a problem for day cases and further analgesic studies will be necessary to investigate this aspect. Perhaps the non-steroidal anti-inflammatory drugs may hold the answer.

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