

Long-term outcomes of laser-assisted uvulopalatoplasty in 168 patients with snoring

T IYNGKARAN, J KANAGALINGAM, R RAJESWARAN, C GEORGALAS, B KOTECHA

Abstract

Laser-assisted uvulopalatoplasty (LAUP) is an established treatment for snoring. Our institution has been using a modification of the Kamami technique since 1995. Between January 1995 and December 2001, 469 patients underwent LAUP for snoring. A telephone survey of these patients and their partners was conducted retrospectively. One hundred and sixty-eight patients and their partners were interviewed and the findings analysed.

Of the 168 patients, 122 had LAUP alone, 42 had LAUP and tonsillectomy and four had LAUP and septoplasty. The median follow-up time was 59 months (range 19 to 98 months).

Seventy-four per cent reported improvement at six weeks, 69 per cent reported improvement at nine months and 55 per cent reported improvement at the time of interview. To assess the degree of improvement, patients and their partners were asked to grade any improvement in percentage terms. The mean subjective improvement scores were 57 per cent at six weeks (95 per cent confidence interval (CI) 50–64 per cent), 45 per cent at nine months (95 per cent CI 38–59 per cent) and 30 per cent at the time of interview (95 per cent CI 23–35 per cent). Patients who reported weight gain since surgery did not have a poorer outcome than those who reported no weight change or weight loss. Neither did weight loss predict a better outcome. The procedure was generally well tolerated, with only 30 patients (18 per cent) reporting complications (mainly minor).

The benefits of LAUP wane with time and the results are best in the first 12 months following surgery. Our study suggests that 55 per cent of patients selected after sleep studies and sleep nasendoscopy will enjoy long-term benefit.

Key words: Sleep Apnoea Syndromes; Palate; Laser Surgery; Outcome Assessment (Health Care)

Introduction

Laser-assisted uvulopalatoplasty (LAUP) is an established treatment for snoring. Our institution has been using a modification of the Kamami technique since 1995.¹ This technique involves making full thickness incisions from the free edge of the soft palate on either side of the uvula, then shortening the uvula. A pilot study found that incising the soft palate for a quarter of the distance to the hard palate and halving the uvula (and not the neo-uvula) produced the best outcome with minimal complications.² At nine months follow up, 78 per cent of patients reported a snoring improvement of more than 60 per cent.

To date, the reported early results for LAUP have been promising. Kamami, the first to use this technique (in France in 1986), reported complete or near complete elimination of snoring in 85 per cent of treated patients.^{3–5} Walker *et al.* reported 60 per cent cessation or near complete cessation of

snoring and 29 per cent partial cessation of snoring in 105 snorers.⁶ Krespi *et al.*, in their study of 450 patients, reported that 85 per cent treated with LAUP were cured of snoring after completion of treatment.⁷ Wareing *et al.* reported a 55 per cent overall cessation of snoring in their study of 53 patients at 18 to 24 months following LAUP.⁸ The techniques employed by all these groups were similar, and complication rates varied between two and 40 per cent.

There have been very few long-term results of LAUP reported to date, and it is widely held that the benefits of LAUP wane over time. Sharp and Mitchell, in their telephone questionnaire of 53 snorers, reported that 55 per cent were completely satisfied with the results of LAUP at 18 to 24 months following surgery and that 22 per cent were completely satisfied at 70 and 79 months following surgery.⁹

We sought to assess the long-term results of the modified Kamami technique. This paper presents

the results of 168 patients assessed over a period of 19 to 98 months, the largest long-term follow up of LAUP to date.

Patients and methods

Patient selection

Patients who complained of snoring were seen in a multidisciplinary snoring and sleep disorders clinic at our institution. Where possible, consultations are carried out with the patient's partner in attendance. A comprehensive history was obtained, with specific reference to symptoms indicative of possible obstructive sleep apnoea and any history of nasal obstruction, alcohol intake and smoking. All patients are asked to fill in an Epworth sleepiness scale questionnaire at first consultation.

A comprehensive ear, nose and throat examination was performed. Flexible nasendoscopy and a Müller's manoeuvre were performed as part of the assessment. The history and clinical findings were entered into our adult snorer and apnoeics assessment form (see Appendix 1). A full blood count and thyroid function test were performed, and all patients were placed on the waiting list for a sleep study. This was either a home study or full 16-channel polysomnography. Those patients found to have simple snoring or mild to moderate obstructive sleep apnoea were further investigated by sleep nasendoscopy as described by Croft and Pringle.¹⁰ Patients were reviewed in the multidisciplinary clinic and offered treatment based on the results of their investigations. Palatal snorers (i.e. sleep nasendoscopy grades one to two) and mild apnoeics were normally offered LAUP. Patients with significant tonsillar hypertrophy or lateral pharyngeal compression on nasendoscopy were offered LAUP with tonsillectomy.

Patients with co-existent nasal obstruction due to nasal septal deformities were offered a septoplasty, either at the time of sleep nasendoscopy or later with LAUP.

Modified Kamami laser-assisted uvulopalatoplasty

Laser-assisted uvulopalatoplasty was carried out as a day case or overnight stay, depending on the general health status of the patient. The operation was performed under a general anaesthetic with a laser-resistant laryngeal mask airway. The microscope-mounted CO₂ laser was set to deliver a continuous 10 watt pulse. The modified technique involved incising the soft palate for a quarter of the distance to the hard palate and halving the uvula (and not the neo-uvula). In all patients, the posterior faucial pillar was trimmed. The extent of trimming was dictated by sleep nasendoscopy findings, with grade one patients requiring minimal trimming. Tonsillectomy, if indicated, was performed with bipolar diathermy dissection.

Post-operative analgesia was provided in the form of oral sodium diclofenac 50 mg thrice daily (tds) and oral tramadol 100 mg tds for two weeks. Oral

amoxicillin 250 mg tds was also provided as antibiotic prophylaxis for five days.

Survey

The list of patients who had undergone LAUP between January 1995 and December 2001 was obtained from operating theatre records. Contact telephone numbers were obtained from hospital records. If telephone numbers had changed or been inaccurately entered, we used British Telecom's directory enquiries service to obtain the correct numbers.

A simple survey of 11 questions (see Appendix 2) was designed and piloted with a random sample of 20 patients. Alterations were then made to the wording of questions to make them simpler and clearer. The survey was then carried out over a two-day period by two interviewers (TI and JK). Attempts were made to perform interviews with the patients and their partners at times that suited them.

Responses were entered into a computer database and analysed using Microsoft Access software.

Results

The details of a total of 469 patients who underwent LAUP between 1 January 1995 and 31 December 2001 were obtained from operating theatre records. Accurate contact information was available for 350 patients. A significant number of patients had moved house since surgery and were therefore untraceable. All 350 patients were contacted by telephone from the hospital over a two-day period. During this period, 180 patients were away and two refused to be interviewed, leaving 168 patients who provided us with responses. Of these, 100 patients were interviewed with their partners. Only three patients had new partners with no knowledge of their pre-treatment snoring levels.

The median follow-up time was 59 months (range 19–98 months). The mean age was 48 years (range 27–72 years). Eighty per cent of patients were male, 20 per cent female. One hundred and twenty-two patients had undergone LAUP alone, 42 patients had undergone LAUP and tonsillectomy, and four had undergone LAUP and septoplasty.

Overall, 74 per cent ($n = 168$) reported an improvement at six weeks, 69 per cent reported improvement at nine months and 55 per cent reported improvement at the time of interview. The mean subjective improvement scores were 57 per cent at six weeks (95 per cent confidence interval (CI) 50–64 per cent), 45 per cent at nine months (95 per cent CI 38–59 per cent) and 30 per cent at the time of interview (95 per cent CI 23–35 per cent).

Of the patients who had undergone LAUP alone ($n = 122$), 76 per cent reported an improvement at nine weeks, 69 per cent at nine months and 55 per cent at the time of interview (Figure 1). The mean subjective improvement scores amongst patients who had undergone LAUP alone were 57 per cent at six weeks (95 per cent CI 50–64 per cent), 45 per cent at nine months (95 per cent CI 38–59 per cent)

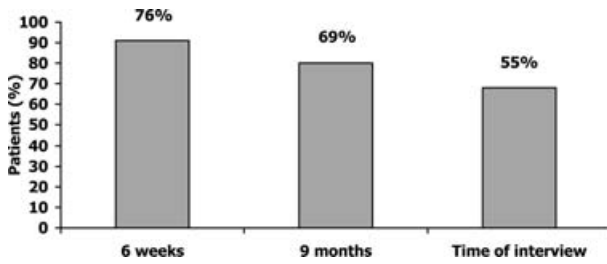


FIG. 1

Patients reporting improvement following laser-assisted uvulopalatoplasty alone ($n = 122$).

and 30 per cent at the time of interview (95 per cent CI 23–35 per cent).

Of the 40 patients who had undergone LAUP and tonsillectomy, 88 per cent reported improvement at six weeks, 85 per cent at nine months and 58 per cent at the time of interview (Figure 2). The mean subjective improvement scores of these patients were 66 per cent at six weeks (95 per cent CI 55–78 per cent), 52 per cent at nine months (95 per cent CI 42–63 per cent) and 28 per cent at the time of interview (95 per cent CI 18–38 per cent). The number of patients undergoing LAUP and septoplasty were too small to allow meaningful analysis.

Of the 129 patients in both groups who reported improvement at six weeks, 92 showed improvement at the time of interview (95 per cent CI 9.96–189.95 per cent). The odds ratio was 43.5 and the chi-squared value was 50.6, with $p < 0.001$. Only two (5 per cent) of the 39 patients who experienced no improvement in snoring at six weeks had some improvement in snoring at the time of interview. This suggests that improvement at six weeks is probably a good indicator of long-term improvement (Table I).

Thirty-five per cent of all patients reported no improvement and 10 per cent reported worsening of symptoms at the time of interview. Eighty-seven patients felt that the operation had been worthwhile and 86 patients (52 per cent) felt that they would have the operation again.

Twenty-six patients (15 per cent) had tried some form of alternative treatment following LAUP. A mandibular advancement splint was the alternative treatment of choice (23 patients), with 83 per cent of the patients reporting a good outcome. Forty-five per cent of patients felt that their weight was unchanged at the time of interview, 40 per cent had

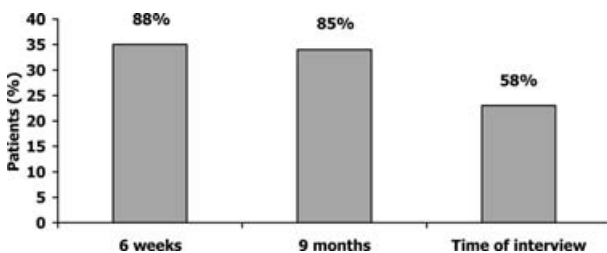


FIG. 2

Patients reporting improvement following laser-assisted uvulopalatoplasty and tonsillectomy ($n = 40$).

TABLE I
ASSOCIATION BETWEEN SNORING IMPROVEMENT AT 6 WEEKS AND AT INTERVIEW

	Snoring improvement at time of interview	
	No ($n = 74$)	Yes ($n = 94$)
No snoring improvement at 6 weeks ($n = 39$)	37	2
Snoring improvement at 6 weeks ($n = 129$)	37	92

put on weight following surgery and 15 per cent had lost weight.

There did not appear to be any relationship between alcohol intake and snoring.

The procedure was generally well tolerated, with only 30 patients (18 per cent) reporting complications (Figure 3). The most common complication was a globus sensation, reported by eight per cent of patients. Over half of these patients reported persistence of this problem to the time of interview. Voice change and nasal regurgitation occurred in seven and six per cent of cases, respectively. Both these complications appeared self-limiting and resolved in weeks (Figure 4).

Bleeding was uncommon, affecting only 13 patients (5 per cent), with only five patients (three per cent) requiring hospital admission. Although tonsillectomy appeared to increase the severity of bleeding, the numbers were too small to assess significance.

Discussion

Snoring is a very common problem, affecting 22 per cent of women and 44 per cent of men between the ages of 30 and 60 years.¹¹ It is due to turbulent flow of air through the upper airway, can arise from obstruction at several levels,¹² and is a cause of physical and psychological problems. In its extreme form, it can lead to job loss and marital strain.

A range of treatment options is available for patients who suffer with snoring. Laser-assisted

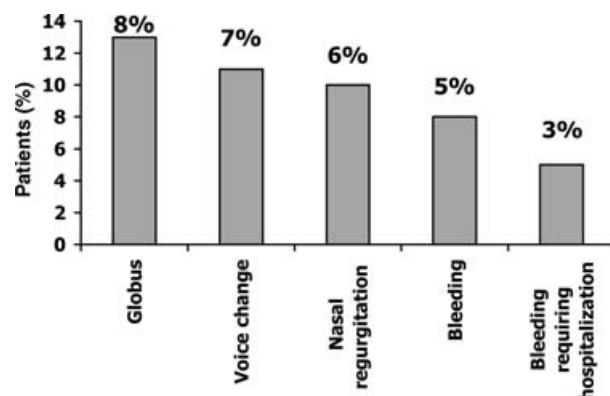


FIG. 3

Types and distribution of complications following laser-assisted uvulopalatoplasty.

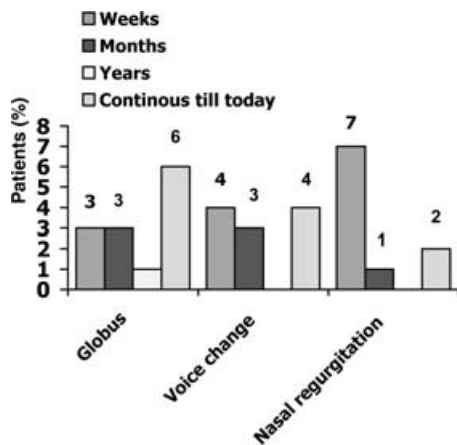


FIG. 4
Duration of complications.

uvulopalatoplasty is one such established treatment option. The short-term results are good in selected patients, with 55–85 per cent reporting some improvement.^{1–8} However, to date, there has been very little reported information on the long-term outcome of this technique, with Wareing *et al.*⁸ and Sharp and Mitchell⁹ reporting long-term success rates of between 20 and 55 per cent.

We sought to assess the long-term results of LAUP in our cohort of patients. Our patients were offered LAUP after a sleep study to exclude significant obstructive sleep apnoea and a sleep nasendoscopy to assess the level of contributory airway obstruction. The decision to proceed with LAUP was made in a multidisciplinary setting in which non-surgical alternatives, such as nasal continuous positive airway pressure and mandibular advancement splints, were also considered. The cohort of patients we surveyed had therefore been highly selected and thus differed from those in other reported series. The modified Kamami technique that we employed was found to offer better outcomes with minimal complications in earlier studies. This technique was performed as a single-stage procedure under general anaesthesia.

Of the 168 patients, 55 per cent reported at least a 30 per cent mean improvement in snoring at a median follow-up time of five years. Only 10 per cent reported a worsening in their snoring. Tonsillectomy with LAUP appears to be more effective than LAUP alone; of the 40 patients undergoing both procedures, more than 85 per cent reported a mean improvement in snoring of at least 50 per cent in the first nine months following surgery.

These results appear much better than those reported by Sharp and Mitchell.⁹ Our study does show, however, that LAUP is most beneficial in the first few months following surgery, with almost 70 per cent of patients reporting improvement in snoring at nine months and 55 per cent at the time of interview. This is in keeping with the published findings of Wareing *et al.*,⁸ that the benefits of LAUP appear to wane with time. It has been postulated that re-development of soft palate flaccidity may be a factor in the failure of long-term snoring control.⁸ This may be further enhanced by weight

gain following surgery. At least 40 per cent of our patients reported weight gain at the time of interview. However, only 11 per cent ($n = 6$) of these patients reported a worsening in their snoring, 35 per cent reported no change and, surprisingly, 54 per cent reported improvement in snoring at the time of interview. Furthermore, of the 17 patients (10 per cent) who reported a worsening in snoring, only 41 per cent reported an increase in their body weight. This suggests that weight gain may not be as important a factor in the recurrence of symptoms as was previously thought. Other possibilities include development of snoring at another site or multi-segmental snoring at the time of initial presentation.¹⁰

Interestingly, our results suggest that early improvement in snoring is predictive of a long-term improvement in this symptom and that no improvement at six weeks results in a poor long-term outcome (Table I). The reasons for this are unclear. It has been assumed that no patient with a poor early result subsequently stopped snoring.⁹ However, of the 39 patients who had experienced no improvement in snoring at six weeks, two patients experienced improvement in their snoring at the time of interview. Of those two patients, one reported a complete cessation of snoring and the other a 50 per cent improvement in snoring. Although these patients represented a very small cohort, this result suggests that LAUP may have a delayed effect in some patients.

We acknowledge the limitations of a telephone interview and of self-reported measurement of snoring by patients. We also acknowledge the problems and difficulties with accurate self-reporting of improvement in snoring done retrospectively, especially when the length of follow up is as long as 98 months. We attempted, wherever possible, to include patients' partners in our interview. We also acknowledge that polysomnography is a more objective means of assessing snoring improvement; however, performing this test post-operatively on 168 patients was not feasible due to waiting list constraints.

This is the largest long-term follow up of LAUP to date. The modified Kamami technique used at our institution was safe, with few complications, and was an effective method of improving snoring. Tonsillectomy with LAUP appears to be more effective than LAUP alone but may increase the severity of secondary haemorrhage. Interestingly, early improvement in snoring appears to be a good predictor of long-term outcome. Laser-assisted uvulopalatoplasty is most beneficial in the first 12 months following surgery. Although it has a relapse rate, like most other surgical remedies for snoring, 55 per cent of our patients reported improvement in snoring at the time of follow up. The results of this study suggest that LAUP is a viable surgical option for patients with snoring.

Acknowledgement

We would like to thank Sarah Ibrahim of the medical audit department for preparation of the telephone questionnaire and Simon Thorne for assistance with preparation of the manuscript.

- **Despite good short-term outcomes with laser-assisted uvulopalatoplasty (LAUP) for snoring, previous reports suggest that this effect wanes with time, with only 55 per cent of patients reporting improvement at two years and 22 per cent at 70–79 months**
- **This was a telephone survey of 168 patients who were selected for LAUP, with or without tonsillectomy, after a sleep study and sleep nasendoscopy. A modified Kamami technique was employed in all cases in a single laser treatment under general anaesthesia**
- **At a median follow up of 59 months, improvement was sustained in 58 per cent of those who had undergone LAUP and tonsillectomy and in 55 per cent in the LAUP alone group**
- **Patients who reported a benefit at 59 months described a partial reduction of snoring intensity only (mean subjective improvement score of 28–30 per cent)**

References

- 1 Kamami YV. Laser CO₂ for snoring. Preliminary results. *Acta Otorhinolaryngol Belg* 1990;**44**:451–6
- 2 Kotecha B, Paun S, Leong P, Croft CB. Laser assisted uvulopalatoplasty: an objective evaluation of technique and results. *Clin Otolaryngol Allied Sci* 1998;**23**:354–9
- 3 Kamami YV. Outpatient treatment of snoring with CO₂ laser: laser assisted UPPP. *J Otolaryngol* 1994;**23**:391–4
- 4 Kamami YV. Outpatient treatment of sleep apnoea syndrome with CO₂ laser, LAUP: laser assisted UPPP results on 46 patients. *J Clin Laser Med Surg* 1994;**12**:215–19
- 5 Kamami YV. Outpatient treatment of sleep apnea syndrome with CO₂ laser: laser-assisted UPPP. *J Otolaryngol* 1994;**23**:395–8
- 6 Walker RP, Grigg-Damberger MM, Gopalsami C, Totten MC. Laser-assisted uvulopalatoplasty for snoring and obstructive sleep apnea: results in 170 patients. *Laryngoscope* 1995;**105**:938–43
- 7 Krespi YP, Keidar A, Khosh MM, Pearlman SJ, Zammit G. The efficacy of laser-assisted uvulopalatoplasty in the management of obstructive sleep apnea and upper airway resistance syndrome. *Operative Techniques in Otolaryngology–Head and Neck Surgery* 1994;**5**:235–43
- 8 Wareing MJ, Callanan VP, Mitchell DB. Laser assisted uvulopalatoplasty: six and 18 month results. *J Laryngol Otol* 1998;**112**:639–41
- 9 Sharp HR, Mitchell DB. Long-term results of laser-assisted uvulopalatoplasty for snoring. *J Laryngol Otol* 2001;**115**:897–900
- 10 Croft CB, Pringle M. Sleep nasendoscopy: a technique of assessment in snoring and obstructive sleep apnoea. *Clin Otolaryngol Allied Sci* 1991;**16**:504–9
- 11 Young T, Palta M, Dempsey J, Skatrud J, Weber S, Badr S. The occurrence of sleep-disordered breathing among middle-aged adults. *N Engl J Med* 1993;**328**:1230–5
- 12 Kotecha B, Shneerson DM. Treatment options for snoring and sleep apnoea. *J R Soc Med* 2003;**96**:343–4

Appendix 1. Adult snorer and apnoeics assessment form

Name:	Hospital no:		
Date of birth:	Sex:		
Occupation:	Spouse or partner present:		

HISTORY

Presenting complaint:	Snoring		
	Apnoea		
	Somnolence		
	Other		

NOCTURNAL SYMPTOMS

Abnormal motor activity Y/N	Never	Sometimes	Always
-----------------------------	-------	-----------	--------

Restlessness
 Sleep walking
 Awakenings
 Autonomic events Y/N
 Night sweats
 Reduced libido
 Enuresis

DAYTIME SYMPTOMS

Morning headache
 Unrefreshing sleep
 Excessive daytime somnolence
 Cognitive changes
 Reduced concentration
 Memory lapses
 Epworth score

Continued

Appendix 1. Continued

SOCIAL HISTORY				
Accidents	Y/N	No of driving accidents in last 5 years		
Alcohol	Y/N	No of units per week		
Drugs	Y/N	Specify		
Smoking	Y/N	No per day		
PAST MEDICAL HISTORY				
Operations	Y/N			
<i>Medical conditions:</i>				
Cardiac	Y/N	Hypertension IHD angina MI CVA		
Pulmonary	Y/N	Asthma Bronchitis Emphysema		
Endocrine	Y/N	Specify		
Nasal symptoms	Y/N			
EXAMINATION				
Height		Body mass index		Wt/Ht
Weight				Kg/m
Neck circumference				
Nose				
Oropharynx	Tonsils Palate Pharyngeal wall	Y/N Thickened Redundant folds Y/N	Grade Congested	Prominent uvula
Nasendoscopy	Normal If no specify	Y/N Nasal cavity Soft palate Larynx	Nasopharynx Oropharynx	
Müller	Collapse	Y/N		
Site and degree of collapse	>25% Soft palate Oropharynx Tongue base	>50%	>75%	100%

Appendix 2. Laser-assisted uvulopalatoplasty questionnaire

Question 1: Did you suffer any complications following surgery?

- (a) Infection needing antibiotics
 - (b) Bleeding
 - (c) Bleeding needing you to return to hospital
 - (d) Spillage of fluids through nostril
 - (e) Voice change
 - (f) Choking/lump in throat
 - (g) Other
- (if positive for regurgitation, voice change or globus go to question 2)

Question 2: How long did this last for?

- (a) Continues to this day
- (b) Weeks
- (c) Months
- (d) Years

Question 3: Has your weight changed since the operation?

- (a) Yes increased

- (b) Yes decreased

- (c) No change

Question 4: What is your current weight?

Question 5: How would you describe your alcohol consumption now as compared to that at the time of the operation?

- (a) No change
- (b) Less
- (c) More
- (d) Never drink

Question 6: Since the operation, have you started any new medication?

- (a) Yes
- (b) No
- (c) Don't know

Question 7: Comparing your present condition with your condition before surgery, has your snoring:

- (a) Worsened
- (b) Not changed
- (c) Improved

Question 8: By what percentage has your snoring improved? (0–100%)

Question 9: Would you describe this operation as worthwhile?

- (a) Yes
- (b) No
- (c) Don't know

Question 10: Would you have this operation again?

- (a) Yes
- (b) No
- (c) Don't know

Question 11: Have you tried any alternative treatments for snoring since the operation?

- (a) Yes
 - (b) No
-

Address for correspondence:

Mr B Kotecha,
Consultant ENT Surgeon,
Royal National Throat, Nose and Ear Hospital,
330/332 Grays Inn Road,
London WC1X 8DA, UK.

E-mail: bhikkot@aol.com

Mr B Kotecha takes responsibility for the integrity of the content of the paper.

Competing interests: None declared
