Ear protection as a treatment for disruptive snoring: do ear plugs really work?†

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Abstract
Background: In the absence of surgical treatments with demonstrable long-term efficacy, conservative treatments for snoring remain appropriate. Only limited evidence evaluating the use of ear protection by partners has been published.

Methods: Eligible couples were invited to participate in a two-month trial, with each partner using custom-moulded ear plugs. Five questionnaires were completed by patients and their partners, at baseline and after two months: the snoring outcomes survey (SOS) or the spouse/bed partners survey (SBPS), the Epworth sleepiness scale (ESS), the general health questionnaire-12 (GHQ-12), the Nottingham health profile (NHP) and the Golombok–Rust inventory of marital status (GRIMS).

Results: After two months, there was a significant improvement in the SOS score for patients (p = 0.005), the SBPS score for partners (p = 0.001) and the ESS for partners (p = 0.004).

Conclusions: For selected couples, ear plugs represent an effective short-term treatment for some of the social effects of disruptive snoring, as determined by the SOS, SBPS and ESS questionnaires.

Key words: Snoring; Therapy; Ear Protective Devices

Introduction
Disruptive snoring is known to have a detrimental effect on the quality of life and relationship satisfaction of snorers and their partners.1,2 Patients referred with disruptive snoring as their principal complaint are often brought to the clinic by their partner. Both snorer and partner may complain of poor sleep quality, daytime fatigue, reduced quality of life and marital strain secondary to disruptive snoring.3,4

Conventional treatments target the snorer and are directed towards the cause of snoring (transient upper airway obstruction).1 However, the long-term results of surgery remain poor and associated morbidity high. Indeed, it is now a Scottish inter-collegiate guideline network (SIGN) grade B recommendation that uvulopalatopharyngoplasty should not be used as a treatment for apnoeic snorers.5

Intra-oral devices are an alternative treatment for snoring. It is currently a SIGN grade A recommendation that these devices are an appropriate therapy for snorers.6 However, long-term compliance with intra-oral devices varies from 50 to 100 per cent.6,7 Whether these devices represent a cost-effective treatment for non-apnoeic snoring populations also remains unproven.8 Nasal continuous positive airway pressure (CPAP) devices are also used in some centres as a treatment for both obstructive sleep apnoea/hypopnoea syndrome (OSAHS) and non-apnoeic snoring.

An alternative approach to the treatment of disruptive snoring is to target the snorer’s partner.8 The effects of snoring on the partner include poor sleep quality, sleep deprivation and daytime fatigue.8 Only limited and low level evidence has been published evaluating the effectiveness of partner ear protection in the symptomatic treatment of both snorer and partner.8 The hypothesis is that the use of custom-moulded ear plugs may improve the sleep quality of the partner, which in turn may improve the sleep quality of the snorer, who would be disturbed less frequently by their protesting partner.

The aim of this trial was to determine prospectively by questionnaire whether custom-moulded ear plugs, worn by bed partners, had an effect on the perceived snoring severity, daytime fatigue, relationship satisfaction and quality of life of snorers and their partners.

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Accepted for publication: 24 October 2005.
Materials and methods

One hundred and fifteen patients were referred to the department of otorhinolaryngology–head & neck surgery (ORL-HNS) at the Glasgow Royal Infirmary with a snoring complaint. All snorers were asked to attend the clinic with their partner. Attending snorers were assessed for OSAHS in accordance with the current SIGN guideline. Each snorer underwent comprehensive ENT examination, including nasoendoscopy and flexible laryngoscopy, to exclude mucosal pathology of the upper aerodigestive tract. Where appropriate, referral was made for sleep study investigation, mandibular advancement device fitting or surgery.

Ethical approval for this trial was granted by the research ethics committee of the North Glasgow University Hospitals National Health Service Trust. Prior to planned treatment or investigation, eligible couples were invited to participate in the ear plug trial. Partner exclusion criteria included past or present ear plug usage and an otological history. Each partner had ear impressions taken and a set of ear plugs manufactured. The ear plugs were non-vented and were known to attenuate sound by approximately 20 dB (Starkey Laboratories Ltd, Stockport, Cheshire, UK).

The questionnaires detailed below were given to the couples and completed at baseline and following the two-month ear plug trial. Questionnaires were either completed at the out-patient clinic or by return of post. The importance of completing the questionnaires independently was emphasized to all couples, and when necessary individuals were reminded by telephone to return their completed questionnaires.

Snoring outcomes survey and spouse/bed partners survey

The snoring outcomes survey (SOS) consists of eight questions evaluating the duration, severity, frequency and consequences of disruptive snoring. It has been shown to be valid, reliable and sensitive to clinical change following treatment in snoring populations. The spouse/bed partners survey (SBPS) has also been developed by the Boston group and consists of three Likert-type items. Both surveys provide a numerical score ranging from zero (worst) to 100 (best), and scores are compared before and after snoring treatment.

Epworth sleepiness scale

The Epworth sleepiness scale (ESS) questionnaire is widely used in the assessment of sleep-disordered patients. It represents a validated method for assessing patients’ perceptions of daytime fatigue or sleepiness. The ESS provides a numerical score ranging from zero to 18. A score of less than 11 is defined as normal, 11 to 14 is defined as mild, 15 to 18 as moderate and greater than 18 as severe subjective daytime sleepiness (SDS).

Golombok–Rust inventory of marital status

The Golombok–Rust inventory of marital status (GRIMS) has been shown to be valid and reliable in detecting changes in a marriage that develop as marital therapy progresses. It was used in this trial to determine the baseline marital satisfaction of the couples and to detect changes following ear plug usage. The GRIMS is a 28-item test which yields a numerical score ranging from zero (best) to 84 (worst) corresponding to nine categories of marital satisfaction. These categories range from ‘severe problems’ to ‘undefined’.

Nottingham health profile

The Nottingham health profile (NHP) is a reliable and valid instrument with which to measure patient’s perceived health status, encompassing physical, social and emotional problems. It consists of two sections. Section one contains 38 questions reflecting the subject’s perceived distress within six categories (emotional reactions, sleep, energy, pain, physical mobility and social isolation). A numerical score is produced for each category ranging from zero (worst) to 100 (best) and an overall quality of life score can also be calculated. Section two assesses the subject’s perception of various social functions (employment, house work, social life, home relationships, sex life, hobbies and vacations). For this study, serial questionnaire scores were compared to detect changes in individual categories and in overall quality of life following ear plug usage.

General health questionnaire

The general health questionnaire (GHQ-12) was used as a screening instrument for the presence of non-psychotic psychiatric illness in the trial cohort. It is a 12-item test yielding a numerical score ranging from zero (worst) to one (best). For this study, the usual GHQ scoring system was used (0-0-1-1). A score of greater than 0.66 was accepted as positive for the presence of psychiatric illness.

Results and analysis

One hundred and fifteen snorers were referred to the clinic with snoring as their principal complaint (see Table I). Twenty-seven snorers failed to attend two consecutive first appointments.

<table>
<thead>
<tr>
<th>TABLE I</th>
<th>PATIENT RECRUITMENT</th>
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<tbody>
<tr>
<td>Patients referred</td>
<td>115</td>
</tr>
<tr>
<td>Did not attend</td>
<td>27</td>
</tr>
<tr>
<td>No current bed partner</td>
<td>23</td>
</tr>
<tr>
<td>Exclusions</td>
<td>18</td>
</tr>
<tr>
<td>Total snorers eligible</td>
<td>47</td>
</tr>
<tr>
<td>Refusal</td>
<td>24</td>
</tr>
<tr>
<td>Recruited into trial</td>
<td>23</td>
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</table>
Twenty-three snorers had no current bed partner. Eighteen couples were excluded (12 partners had used ear plugs previously and six had an otological history). Consequently, 47 couples were eligible for the trial. Twenty-three couples were recruited and 24 refused (including 16 couples who refused because they had young children in the house at night). One couple subsequently withdrew from the trial due to serious, unrelated illness. One couple were lost to follow up, yielding a cohort of 21 couples with complete data following a two-month trial. Ear plug usage was tolerated well, with no complications.

**Snoring outcomes survey and spouse/bed partners survey**

There was a highly significant difference between the median SOS score of snorers ($p = 0.005$) and the median SBPS of partners ($p = 0.001$) at zero and two months (see Table II).

**Epworth sleepiness scale**

On Wilcoxon signed rank testing, there was a significant difference in the median Epworth score for partners at zero and two months ($p = 0.004$, see Table III). There was no difference in the median Epworth score for snorers at zero and two months ($p = 0.583$). At baseline, seven snorers and 13 partners had a normal Epworth score ($<11$). At baseline, eight of 21 snorers had a higher Epworth score than their partner. Following the two-month ear plug trial, 17 snorers had a higher Epworth score than their partner.

**Golombok–Rust inventory of marital status**

Seventeen snorers and 16 partners had a GRIMS score of average or better at baseline. No significant difference in score was noted following ear plug usage (see Table IV).

**Nottingham health profile**

The median total NHP score for the snorers improved from 35 to 26.3 ($p = 0.044$). There was no significant change in the median total NHP score for partners. Snorers’ median score in the ‘emotion’ and ‘social’ categories of the NHP also improved ($p = 0.006$ and $p = 0.016$, respectively). There were no significant changes in the other NHP scores.

**General health questionnaire**

Three snorers and one partner scored $>0.66$ on the GHQ-12 at baseline, indicating the presence of non-psychotic psychiatric behaviour. After two months, only one of these individuals (a snorer) had a score $>0.66$. One partner scoring 0.33 at baseline subsequently scored 0.75 (test positive) at two months.

**Discussion**

In the absence of surgical treatments with demonstrable long-term efficacy and acceptable complication rates, conservative first line treatments for snoring remain appropriate. Intra-oral devices and nasal CPAP devices aim to alleviate the upper airway obstruction that causes snoring. Conversely, ear plugs aim to alleviate the noise disruption that results from snoring.

The significant improvement seen in SOS and SBPS scores for both snorers and partners demonstrates improvement in perceived snoring severity and sleep-related quality of life. There was a reduction in the median Epworth score of both snorers (from 13 to 12) and partners (from nine to seven, $p = 0.004$), suggesting an improvement in subjective daytime sleepiness. However, these numerical changes may not be clinically significant since there was no change in the median category of SDS (as defined by the ESS) for either group following ear plug treatment. In addition, the sample size in this trial was small. Whilst a sample of 21 is sufficient for the SOS to detect clinical change, a power study was not performed for the ESS.

Despite the fact that marital disharmony and relationship dissatisfaction are very common complaints made by both snorers and their partners, the majority of couples in this trial scored average or better on the GRIMS questionnaire at baseline. This finding has been corroborated by several other studies and can also be interpreted in several ways.4,14 Couples willing to attend the clinic for
investigation and treatment of snoring may have a stronger relationship than couples who choose not to attend together and therefore do not participate in the trial. This would represent selection bias, and consequently the GRIMS questionnaire may not be a relevant outcome measure in the absence of a control group.

The finding that ear plugs had a greater effect on the overall health-related quality of life of snorers rather than of their partners, as determined by the NHP questionnaire, can be explained in several ways. One explanation is that the act of being woken up by a protesting partner throughout the night has a more detrimental effect on the snorer’s quality of life than the effect of noisy snoring on the partner’s quality of life. As a result, when the partner’s sleep quality improves with ear plug usage and the snorer is disturbed less often, there is a disproportionate improvement in the snorer’s quality of life. Although this is speculative, it is interesting to note that the median total NHP score of snorers was much lower than the median score of partners (35 and 16, respectively) at baseline.

The GHQ-12 questionnaire results give further credence to the belief that psychiatric disorder is prevalent in both snorers and their partners. It is clear that ear plugs do not represent an appropriate treatment for all couples seeking treatment. Our trial cohort did represent a highly selected group. As shown in Table I, only 47 of the 88 snorers seen at the clinic were eligible for the trial and only 23 of the 47 eligible couples were recruited. This represents a recruitment rate of approximately one in four.

Nevertheless, we believe it would be advantageous if even one in four referrals could be treated with this simple, non-surgical intervention. The high number of snoring referrals made to ENT departments represents a significant clinical workload. Our clinic currently receives 140–160 snoring referrals annually from a population of 250000 in north and east Glasgow. The ear plugs used were manufactured at a cost of £11.71 per pair. In comparison with the cost of intra-oral devices and nasal CPAP machines, ear plugs therefore represent an inexpensive treatment option for snoring.

Conclusion
This study demonstrated that the use of ear plugs by the partners of snorers improved the SO, SBPS and ESS scores of both snorers and partners after two months. From this, we conclude that, for some couples, ear plugs represent an effective short-term treatment for some of the social effects of disruptive snoring as determined by these questionnaires. It is clear that a larger, randomized and controlled trial comparing the efficacy of ear plugs and other conservative treatments for snoring (such as nasal CPAP and intra-oral devices) is required.

- The long-term results of surgery for snoring remain poor. Conservative first line treatments are therefore appropriate
- Only limited evidence has been published evaluating the effectiveness of partner ear protection in the symptomatic treatment of both snorer and partner
- This prospective cohort study set out to recruit a large cohort of subjects but few participants completed the study
- However, the results seem to suggest that, for selected couples, partner ear protection is an effective short-term treatment for some of the social effects of disruptive snoring

References

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S Stuart Robertson takes responsibility for the integrity of the content of the paper.
Competing interests: None declared