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Review Article

The surgical treatment of snoring

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There is an intense interest in the 'surgical treatment of snoring' and new techniques are described with increasing regularity both in the medical literature and the popular press. At the Ninth British Academic Conference in Otolaryngology (July 1995) one plenary session, one instructional session, three videos and more than 10 per cent of the posters were devoted to this topic. This paper relates to the treatment of snoring alone having excluded sleep apnoea on the history or by the appropriate investigations.

However, in the various new procedures which are described, exact details of the operative techniques are rarely provided and this omission from many of the papers is of particular significance when one of a range of lasers or diathermy is used for part or all of the procedure. The aim of this paper is to draw attention to the widely differing tissue effects of the lasers which are commonly used in this surgery and to the tissue effects of monopolar diathermy.

Credit for the introduction of uvulopalatopharyngoplasty (UPPP) for the treatment of snoring must be given to Ikematsu who developed the procedure in Japan more than 30 years ago (Ikematsu, 1964). However, the operation was not widely recognised or practised until Fujita described the technique in the 'western literature' in 1981 (Fujita *et al.*, 1981).

Fujita's operation was modified by Simmons *et al.* in 1983 and it has undergone, and continues to undergo, minor modifications and refinements in an attempt to develop the 'perfect procedure' with optimal results and minimal complications. In addition, 'palatal stiffening operations' have been described based on the 'Ellis procedure using the neodymium yttrium aluminium garnet (NdYAG) laser' (Ellis *et al.*, 1993) and a number of limited palatal resections using the carbon dioxide (CO_2) laser have also been described, such as the 'laser assisted uvulopalatopharyngoplasty' (LAUP) described by Kamami in 1994. The use of diathermy to cause palatal stiffening and contracture has also been described (Whinney *et al.*, 1995).

There now appears to be an 'essentially standard procedure' for UPPP with minor modifications adopted by individual surgeons. The procedure involves the removal of the tonsils or, if absent, the tonsillar fossae are de-epithelialized, the mucosa of the anterior and posterior faucial pillars is trimmed and the pillars are sewn together to 'tighten' the mucosa of the posterior pharyngeal wall. An 'appropriate amount' of soft palate is then removed usually up to 1.5 cm and the palatal wound may be sutured either fully or only at the lateral margins.

However, there appears to be no standardised technique for the performance of this relatively standard procedure, which may be performed using scissors and scalpel, with diathermy or ligatures for haemostasis. Others use cutting monopolar diathermy for the palatal resection and there is an increasing interest in the use of a range of lasers for the performance of all, or parts of the procedure.

Results of UPPP are compared from different studies without reference to differences in technique and scant attention appears to have been paid to the tissue effects of the various devices and how these may influence the outcome of the procedure. This lack of attention to detail is of particular relevance when lasers are used as it is essential to provide details of the laser parameters (power density, imprint size, and exposure time) with relevant details of the laser/tissue interactions and, indeed, why a laser is preferred to conventional techniques.

A large amount of work has been carried out on the quantification of damage lateral to a wound cut by a laser and there are three main thermal effects of lasers relevant to these procedures: vaporization; necrosis with sloughing; necrosis with healing by scarring.

Far infra-red CO_2 laser energy is absorbed by water and removes tissue by instantaneous vaporization at a temperature of 100°C. It is estimated that

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there will be damage to a depth of 0.1 mm lateral to the laser wound and it has been shown by Fisher *et al.* (1983) that mucosal wounds cut by this laser will contract less than those cut by conventional techniques.

The KTP (potassium titanyl phosphate) and Argon lasers produce blue/green coherent light which is absorbed by vascular and pigmented structures. At the edges of a resection carried out with these lasers there will be thermal damage to a depth of approximately 1 mm.

However, near infra-red NdYAG laser energy is deeply absorbed in tissues without colour or tissue specificity. The depth of damage lateral to a NdYAG laser incision may extend up to 5 mm and of this 2–3 mm will slough and the next 2–3 mm will heal with considerable fibrosis (Bown, 1991).

The depth of thermal damage adjacent to a wound cut by monopolar diathermy depends on a number of factors but it is considerably greater than that caused by the NdYAG laser. Lombard *et al.* (1982) have shown that the temperature rise in tissues 2 mm lateral to a wound cut by monopolar diathermy is ten times greater than that, at a similar distance, from a wound cut by the NdYAG laser.

The deep damage to the palate below the strip of mucosa excised with the NdYAG laser is the 'reason for success' of the palatal stiffening procedure described by Ellis *et al.* (1993) but this procedure would not, for obvious reasons, produce the same results if it were to be performed by CO_2, argon or KTP lasers although the monopolar diathermy will certainly cause substantial thermal damage with scarring and contracture.

Similarly, the precise cutting of tissue achieved by the CO_2 laser appears to be ideal for the palatal resection either for the standard UPPP or for LAUP, as there will be negligible thermal damage and no significant necrosis or scarring. There will be a moderate amount of thermal damage with the KTP or argon lasers but, if the NdYAG laser is used there will be significant further necrosis and scarring and this problem will be even greater if monopolar diathermy is used for this resection.

The results of UPPP or LAUP depend on the precise removal of the correct amount of palate. If the correct amount is removed with an inappropriate device, without due consideration of the tissue effects, results may be inferior with a higher rate of complications.

It is essential for any surgeon performing these procedures to understand fully the tissue effects of the device which is being used and to provide full details of the technique which is being carried out so that an *ideal technique* can be developed which can be readily reproduced by other surgeons in this field.

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