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BRITISH
Journal of
Oral and
Maxillofacial
Surgery

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New method for the objective evaluation of injury to the lingual nerve after operation on third molars

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Accepted 21 November 2004

Available online 26 January 2005

KEYWORDS

Lingual nerve;
Nerve lesion;
Jaw-opening reflex;
Masseteric inhibitory
reflex;
Quantitation of nerve
injury

Summary Existing tests of function of the lingual nerve are either subjective or, when they elicit the jaw-opening reflex, are dependent on the cooperation of the subject. We report a study in 12 healthy volunteers and 12 patients with iatrogenic injury to the lingual nerve. A bite block (containing stimulating electrodes) was held between the teeth and the tongue was held on to the electrodes by suction. When the lingual nerve was intact, an electrical stimulus elicited brief inhibition of masseteric electromyographic activity. Local analgesia and iatrogenic injury to the lingual nerve altered nerve conduction and caused a reduction in reflex inhibition. Two methods, compatible with limited numbers of applications of the stimulus, were used to quantify responses. One used an indirect measurement of intervals between action potentials of muscle and the other used a measurement of rectified signals falling below the mean amplitude before and after the stimulus. Both methods gave values that correlated with subjective sensations. The first gave an estimate of the probability of defining major malfunction of the nerve objectively; the second gave a linear measurement that allowed recovery of the nerve to be followed.

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Introduction

Many studies have reported that the removal of lower third molars causes temporary injury to the lingual nerve in up to 23% of patients and permanent injury in up to 2%.¹ It is therefore desirable

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to have an objective test of function of the lingual nerve. Conventionally, the integrity of a nerve is tested by applying a stimulus to skin or mucosa and asking the patient what he or she feels. This is used as an indicator of the integrity of the sensory nerve fibres. However, in the orofacial region, the sensitivity to such tests varies widely across different sites² and the results of the tests do not correlate well with the damage to the afferent nerve that is found at operation.³ There is also the problem that these tests fail to differentiate between sensory loss resulting from a peripheral lesion and sensory loss from a central lesion. Afferent nerve function can, however, be assessed without involving a conscious response, simply by testing for the presence or absence of a local reflex (Fig. 1). If the central and efferent components of the reflex arc can be shown to be intact but the reflex is absent, then the afferent limb must be the defective element. In the orofacial region, an appropriate test is the jaw-opening reflex.⁴ The reflex comprises inhibition of the motor fibres that cause the jaw to close,^{5,6} and it can be elicited by electrical stimulation of various orofacial sites. The response is expressed as a brief reduction in the extent of the

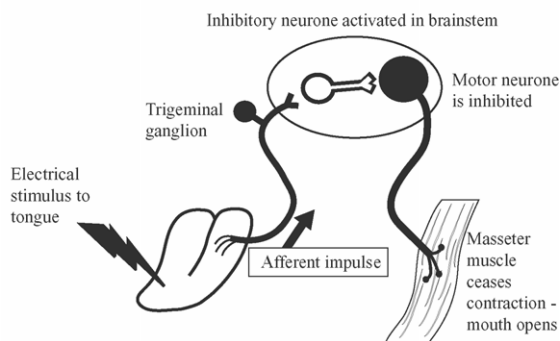
existing electromyographic (EMG) activity produced by conscious clenching of the muscles that close the jaw after the stimulus. When the stimulus is applied to an uninjured site, the inhibitory reflex is expressed bilaterally,^{4,7,8} so the central and motor components of the reflex can be tested by stimulation on the side on which the lingual nerve is intact. Provided that the central and motor components of the reflex are intact, stimulation of the tongue on the side of the damaged nerve will then test for adequate conduction in the afferent nerve.

Many different methods have been advocated for measuring the inhibition of the reflex by EMG activity. These vary from visual inspection to computer-based statistical methods.^{6,9,10-13} The EMG activity is usually measured by full-wave rectification and the data from successive stimuli are averaged. Reliable objective measurement of the reflex therefore requires the responses to a large number of stimuli (sometimes up to 72) to be averaged and, in all cases, the subject has to cooperate by attempting to maintain a steady level of EMG activity in the masseter muscle.^{11,12} However, after iatrogenic injury to the lingual nerve, some patients are apprehensive and may be unable to cooperate satisfactorily, particularly when there is an associated dysaesthesia or glossodynia. An additional problem, in medicolegal cases, is that some patients may not be motivated to cooperate fully.

In most published methods, the mean of the rectified value of EMG activity before stimulation is used as the reference with which the value after stimulation is compared. However, the value of the EMG signal before stimulation is substantially variable about its mean, so a reflex can be considered to be present only if the mean value after stimulation is significantly lower (more than 2 S.D.) than the mean before stimulation.¹¹ These conditions can be met satisfactorily in experimental subjects by using a large number of stimuli. If, however, the number of stimuli has to be limited to be acceptable to a patient with, for example, glossodynia, the S.D. of the value before stimulation increases considerably. The problem then is that weak inhibition, such as may be present in the initial stages of recovery of the lingual nerve, may not reduce the value of EMG activity after stimulation to a significant extent. Conventional methods can therefore make it impossible to show the presence of a weak reflex.

Our aim was to develop and test methods of establishing the presence or absence of a weak jaw-opening reflex, using the small number of stimuli likely to be used in subjects who were unable to cooperate fully. The method was tested on healthy volunteers, in some of whom local analgesia was used to mimic a lesion of the lingual nerve.

A. Healthy lingual nerve



B. Injured lingual nerve

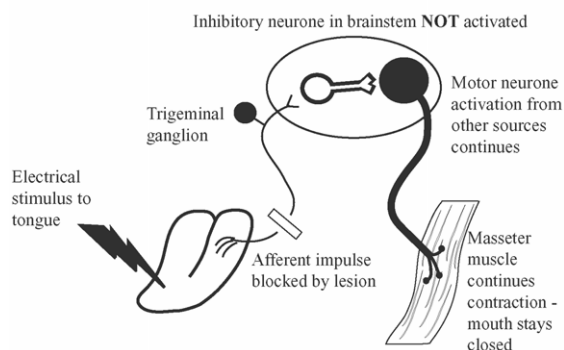


Figure 1 Diagrammatic representation of the neural pathway of the human jaw-opening reflex before and after a lesion of the lingual nerve. See Introduction for further explanation.

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