Fig. 10.6 a - c
The use of electrosurgery prior to impression procedures for partial coverage restorations.

Electrosurgical tissue retraction in the interdental area between partial coverage preparations in the upper right quadrant.

a

A view taken at one week post-operative of the response to electrosurgical retraction on the upper right quadrant. The interdental tissues on the upper left side have just been treated with electrosurgery. The cervical margins are exposed and easily accessible for an elastic impression material.

b

Periodontal and occlusal factors in crown and bridge procedures

with editorial assistance from Brian J. Parkins

The electrosurgical method

Electrosurgery is based on the principle that alternating current of sufficiently high frequency can pass through living tissues without producing an electric shock. The resistance to the passage of the current through the tissues generates heat. The amount of heat depends upon the type of current and the mode of application. It can vary from a mild sensation, hardly perceptible by the patient, to total molecular disintegration of individual cells. This feature of cellular destruction is the essential difference between the use of electrocautery and electrosurgery. The word 'cauterity' is derived from the Greek word 'kauterion', meaning 'branding iron'. This is an apt description of what happens when this procedure is applied to living tissue. Healing following the use of electrocautery is slow, poor and unpredictable. It is similar to the healing of a third degree burn and, given...
the alternatives now available, has no place in modern restorative dentistry. Similar problems follow the use of a monothermal fulgurating current. The ultimate contour and height of the gingiva are difficult to predict because of dehydration and carbonisation of the affected tissues. Fulgurating current is not therefore suitable for the refined tissue excision needed for the exposure of subgingival preparation margins. The only suitable current is filtered and fully rectified. This permits control of the energy at the tip of the electrode so that only individual cells undergo molecular disintegration, thus permitting accurate control of tissue removal. A filtered, fully rectified type of current makes it possible for the operator to predict the outcome of the healing process, together with the post-operative height and contour of the gingival margin.

There are many types of electrosurgical units available, but the choice should be limited to those units which can deliver a filtered, fully rectified current together with a variable wave frequency. Maness et al. (1978), showed that an electrosurgical unit with full-wave rectification and a 1.7 MHz frequency of operation produced significantly greater tissue alteration than a full-wave rectified machine with a 4 MHz frequency of operation. Histological studies in the same piece of research showed that a band of coagulation necrosis, approximately 50 microns wide, was present along the margin of the incision. This was characteristic for all machines tested.

The use of a ground plate, also called a neutral or passive electrode, allows for a more stable and constant current to be generated and also reduces the intensity required. The lower the intensity of current the less the amount of lateral heat produced, which improves the control over tissue alteration.

Tissue response to electrosurgery varies with both the operating frequencies and the waveform. It is essential to start from the principle that the current is properly applied because, no matter how accurate the current and waveform are, an incorrect application produces adverse postoperative tissue responses. These can vary from minor postoperative discomfort, to severe pain and sequestrum formation some weeks later. The following rules should be observed when electrosurgery is used to expose subgingival preparation margins.

1. Use only a fully filtered and rectified current from a machine which can deliver a high frequency output (4 MHz).
2. The movements with the active electrode should be executed quickly, accurately and in a precise manner. Any hesitation during the sweep with the electrode may lead to a localised concentration of electrical energy, producing deeper tissue involvement. Damage to the underlying alveolar bone may occur and give rise to prolonged post-operative discomfort. The slower the movement of the electrode, the greater the amount of lateral heat developed. If an initial sweep does not remove sufficient tissue, several seconds must elapse to allow for heat dissipation before repeating the movement.

3. No pressure should be applied to the tissues with the electrode. Pressure increases the depth of penetration and the likelihood of bone trauma, which may result in the more serious complication of sequestration.

4. The electrode should move continuously. A stationary electrode produces a localised increase in energy discharge which in turn prevents control of penetration.

5. The cutting current must be used at the correct intensity so that the tip of the electrode can pass through the tissue without any difficulty. If resistance is encountered the tissue is likely to adhere to the electrode.

6. Prolonged contact of the electrode tip with metal restorations should be avoided. A spark can be seen on short contacts, but this does not necessarily cause any damage (Scheid et al., 1972). Contact between an activated electrode and toothstructure should be brief because after one second the temperature of the pulp can rise by 4°C, after two seconds by 9°C and after three seconds by 16°C. An increase of more than 10°C above normal body temperature can cause irreversible damage (Zach and Cohen, 1965).

7. Electrosurgical devices are not usually used on patients with cardiac pacemakers. This is a sensible stance to adopt, although some pacemakers are not affected by these machines.
Clinical application of electrosurgery

Electrosurgery prior to impression procedures should only be contemplated on healthy gingival tissue. Manipulation of inflamed gingival tissue leads to unpredictable results with regard to the height of the gingival tissue, because of the lack of control over the healing process. Electrosurgery is contraindicated if thin fragile marginal tissue is present because the slightest damage can produce uncontrollable recession.

Deep anaesthesia is required when using electrosurgery. Experience has shown that regional block anaesthesia has to be supplemented with local infiltration of the gingival tissue surrounding the prepared tooth. The area to be treated is isolated with cotton rolls which produce the desired dryness. The unpleasant odour associated with tissue disintegration can be removed through central suction. It is also important to remove necrotic carbonised tissue tabs by rubbing over the treated area with a 2" x 2" piece of gauze. This is followed by irrigation with 3% hydrogen peroxide solution introduced under pressure into the gingival crevice with a spray bottle. The optimum astringent action is obtained over a period of 2 - 3 minutes. Some bleeding may still occur, but this can be controlled by either placing an alum impregnated cord into the enlarged sulcus or, alternatively, using a haemostatic agent.

A satisfactory haemostatic solution is Levo Epinephrin bi-Tartrate (4%) and alum (9%) (Bassett et al., 1964). A prescription for a modified haemostatic solution is:

<table>
<thead>
<tr>
<th>Levo Epinephrin bi-Tartrate</th>
<th>4%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Potassium Alum</td>
<td>9%</td>
</tr>
<tr>
<td>Sodium Pyro Sulphite</td>
<td>0.5%</td>
</tr>
<tr>
<td>Trichlorisobutyl alcohol</td>
<td>0.5%</td>
</tr>
<tr>
<td>Di-Sodium Edetate</td>
<td>0.1%</td>
</tr>
<tr>
<td>Distilled water to 50 cc</td>
<td></td>
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</tbody>
</table>

This preparation is non-caustic and can be prepared by any pharmacist. Sodium Pyro Sulphite acts as an anti-oxidant, Alcohol Trichlorisobutyl alcohol is the solvent and Di-Sodium Edetate is a chelating agent.

When exposing subgingival margins the 'cutting' electrode should be angled in such a way as to remove tissue primarily from the inner aspect of the gingival sulcus. An electrode with a long closed loop is very appropriate for this purpose (Fig. 10.4).

It is important to note that the position and angulation of the electrode tip will, to a large extent, determine the final form and contour of the gingiva on healing (Fig. 10.2). The working tip of most electrodes is not in line with the handle and has the same inherent problem as the straight explorer when attempting to gain access to certain sites e.g. distal surface of molars. An electrode tip shaped like a curved explorer can be applied more accurately, allowing for the correct exposure of the subgingival preparation margins even in those parts of the sulcus which are difficult to reach. Lampe (1976), developed a technique for preparing an electrode tip to any desired form. This is as follows:

Electrodes fabricated in this way have become world renowned as the 'Lampe-loop' (Fig. 10.4).

Results of studies comparing the healing response of gingival tissue following the use of a scalpel or electrosurgery are inconclusive. Eisenmann et al. (1970), found no differences and their results were confirmed in a clinical, photographic, cytologic and histologic investigation by Arendt and Wade (1973), also in a macro and microscopic investigation by Schneider and Zucki (1974). In contrast to these studies, Pope et al. (1968), showed delayed healing, greater reduction in alveolar height and more bone injury following electrosurgery. This result was also reported by Glickman and Imber (1970). It is postulated that any delay in healing after electrosurgery is due to reduced bleeding. This will produce a reduction in erythrocytes, leucocytes and fibrin which could retard the healing response. It is difficult to make direct comparisons of these results because there was no standardisation of the electrosurgical units and the type of current used.

In general terms it can be said that with proper use the tissue will regain its initial contour after fourteen days. Nevertheless, in clinical practice one should always be acutely aware of possible irreversible periodontal
destruction (Noble et al., 1976). The serious complications and the type of tissue destruction that can ensue following the use of electrosurgery are reported by Simon et al. (1976).

The use of electrosurgical devices for periodontal surgery is to be strongly discouraged. The control of damage to the deeper tissues is very limited, and, in periodontal surgery one is invariably close to or in contact with bone.

As a rule electrosurgery should be restricted to situations where any contact between the active electrode and the alveolar process can be avoided, because even the most fleeting of contacts induces bone resorption (Azizi et al., 1983).

The sequence of events following the improper use of electrosurgery are shown in Fig. 10.5.

Electrosurgical exposure of the margins of a preparation is probably of most use with partial coverage preparations (Fig. 10.6). The real advantage is that the cervical margins can be seen, inspected, and then smoothed or corrected as necessary. Any operator who has used electrosurgery in this way is likely to prefer it to any other method.

Electrosurgery is also used around full coverage preparations (Fig. 10.7). Great care has to be taken on upper anterior teeth where esthetics are of prime importance. A high degree of control is required over the position of the gingival margin, which usually has to cover the collar of ceramo-metal restorations. If the tissues are thin and fragile it is unwise to even contemplate the use of electrosurgery. Its use should then be limited to the palatal aspect, conventional retraction methods being used on buccal and proximal areas.

A good knowledge of electrosurgical principles and controlled use of the equipment are required to achieve optimum, constant and predictable treatment results.