

# Aesthetic failure of anterior crowns

Brenda Baker and David Reaney discuss the techniques, concepts and restorative material to be used for a successful anterior crown restoration

The past four decades have witnessed numerous improvements in metal-ceramic and all-ceramic crowns.

The initial excitement of the metal-ceramic crown was that it theoretically combined the aesthetics of the porcelain jacket crown with the potential for clinical longevity. Shoulder-bevel margins with metal collars were to provide optimal fit and to obtain aesthetics; the metal margins were intended to be hidden within the confines of the gingival sulcus.

This concept proved to be rather unpredictable and lead to the development of numerous techniques for fabrication of all-porcelain margins with metal-ceramic crowns (Jones, 1985).

The evolution of such simplified techniques, along with the introduction of several innovative all-ceramic crown



## Education aims and objectives

This clinical article aims to provide some insights into the processes and materials that can be used to provide crowns in the anterior region.

## Expected outcomes

Correctly answering the questions on page 54, worth one hour of verifiable CPD, will demonstrate that the reader has read and understood the options for providing aesthetically successful, functionally stable anterior crowns.

modalities, has eliminated the need to hide metal margins deep in the gingival sulcus.

However, it is clear that it is impossible to match precisely the shade of the restoration with the colour of the gingival portion of the tooth with these restorations, and in most clinical situations it is still desirable to hide the restorative margins underneath the healthy gingival tissues.

The exception to this statement is bonded porcelain veneers, where tooth reduction is minimal and the restoration is bonded to sound enamel. In these situations, the contact lens effect allows margins to be placed in a supragingival location.

However, the disappointment with the metal-ceramic restorations was the genesis for the development of numerous all-ceramic alternatives to the metal-ceramic restoration (Donovan, 2008).

Many different techniques for fabricating all-porcelain labial margins are available to improve the inherent aesthetic performance of metal-ceramic restorations. When there is sufficient remaining enamel, etched porcelain laminate veneers may be considered to restore the teeth to optimum aesthetics and function.

Failure to obtain optimum results probably has less to do with the restorative medium chosen than it does with failure to adequately prepare the soft and hard tissues to receive the restorations.

In order to achieve aesthetic and functional

success with any and all of the available modalities, it is imperative that the clinician first brings the gingival tissues to optimal health prior to definitive tooth preparation, and maintains this stage of health through the provisional stage.

The clinician must understand the nature

**Figure 1:** In an attempt to mask the discoloured dentine, this preparation has a buccal margin that impinges deeply into the sulcus and is likely to be periodontally compromised



Dr Brenda Baker BDS (Hons) MSc graduated from Sydney University with honours and completed a masters degree in conservative dentistry from Eastman Dental College. She has taught in the prosthetic faculty at Sydney University and pursued a preventively-oriented career in private practice. Throughout her career, Dr Baker has had a commitment to continuing education in a variety of disciplines including prosthodontics, periodontics and pain management, and is currently director of clinical education for Southern Cross Dental.

Dr David Reaney BDS (Edin) DGDP(UK) MClinDent (Prosthodontics) graduated with distinction from the University of Edinburgh. He has held the position of clinical lecturer at the School of Dentistry, Royal Victoria Hospital in Belfast and is currently in private practice in Moy, Northern Ireland. Dr Reaney is general manager of Southern Cross Dental.



**Figure 2:** This preparation demonstrates an ideal finishing line with optimal periodontal health. The likelihood of bleeding is minimal and crevicular fluids are well controlled

of the restorative material to be used and prepare the teeth adequately, in the correct planes, to provide sufficient room for the chosen materials. The dentist must accurately communicate the aesthetic treatment plan to a quality laboratory technician.

## Basic problems

In spite of these technological improvements, the majority of aesthetic failures with such restorations are biologic. The two primary types of aesthetic failure have been recession of the gingival tissues, resulting in exposure of the restorative margins and the presence of chronic marginal gingival inflammation.

There are essentials to the soft tissue management inherent in intracrevicular restorative dentistry related to anterior teeth. The clinician faces two basic problems with the soft tissue management:

1. In situations in which the restorative margins are to be placed in the gingival sulcus and are intended to be hidden by healthy gingival tissues, the goal is to maintain tissue health, and at the same time prevent recession and subsequent exposure of the restorative margin.
2. The restoration has to be placed deep enough in the sulcus to avoid detection, at the same time as keeping the margin an appropriate distance from the attachment or crest of the alveolar bone, so that the biologic width is not violated (Nevins and Skurow, 1984).

## Preventing gingival recession

Gingival recession in adults is not just a natural effect of ageing, but rather is a result of pathology.

If excellent gingival health is attained prior to definitive margin placement and proper clinical techniques are utilised, the relationship between the prepared restorative margin and the gingival tissues can be very



**Figure 3:** This recently cemented bridge is already compromised aesthetically. Improved oral hygiene will most likely expose the finishing line and contrast between the ceramic and root surface

stable, as long as the patient practices proper oral hygiene. There are a number of ways to prevent gingival recession related to anterior crown fabrication, but most of these are under control of the clinician.

If excellent gingival health is attained prior to definitive margin placement, and appropriate restorative techniques are utilised during therapy, the relationship between the prepared cervical margin and the gingival tissues can be very stable over the long term. This assumes adequate professional maintenance and personal oral hygiene over the long term (Kourkouta et al, 2007).

There are five major strategies for preventing gingival recession when placing anterior indirect restorations, and all are primarily under the clinician's control. These strategies are:

### Attaining optimum soft tissue health prior to impression making

Often, patients requiring extensive restoration of anterior teeth do not present with healthy gingival tissues (Nemetz, 1974). The clinical diagnosis may range from mild gingivitis to chronic periodontitis and it is critical that an accurate diagnosis be made and that the appropriate therapy be initiated.

Attainment of optimum soft tissue health prior to determining the final cervical margin location and making the final impression is absolutely critical. With mild gingivitis, the teeth are often prepared, provisional restorations are fabricated and impressions made at the same appointment. This expedited approach is a prescription for disaster.

With placement of the definitive restorations a few weeks later, it is reasonable to assume an improved effort on behalf of the patient to comply with oral hygiene procedures, and in these situations the inflammation in the gingival tissues will often resolve or at least be reduced. In this scenario, the gingival tissues

will move in an apical direction, exposing the restorative margins. This can occur during the provisional phase or shortly after the definitive restorations are placed. In either situation, the clinician is faced with an aesthetic failure.

The optimum approach is to wait to determine the final margin location when the gingival tissues have attained a state of optimal health.

With most anterior restorations, the recommended approach is to prepare the teeth after initial scaling and prophylaxis, leaving the cervical margins in a supra- or equigingival position.

Excellent indirect provisional restorations must be fabricated, which restore optimum crown and gingival tissue contours, provide access for proper oral hygiene and serve as predictors for the definitive restorations (Cho and Chee, 1993; Derbabian et al, 2000; Donovan, 1999).

Gingival enhancement can be achieved by placing the patient on a weak chlorhexidine rinse for two weeks (Marzola, 2000). The optimal location for the cervical margin in the gingival crevice is determined, and the margin is dropped to this predetermined position. The provisional restorations are relined to restore marginal integrity, impressions are made and the patient continues rinsing with mouth rinse until the definitive restorations are placed.

### Minimising iatrogenic soft tissue trauma during margin placement and gingival displacement procedures

In order to avoid iatrogenic recession, it is essential that the rotary instrumentation used to drop the cervical finish line to its final intracrevicular position does not damage the soft tissue. Retraction cord soaked in water should be placed into the sulcus for three to five minutes prior to margin preparation to prevent iatrogenic damage.

On removal of the cord, a defined space permits dropping of the margin with minimal chance for trauma. Use of rotary instruments, especially designed to minimise trauma, is recommended (such as tissue protected end cutting burs).

It is also critical not to damage the attachment apparatus during gingival displacement procedures. The philosophy of attaining optimum gingival health prior to definitive margin location, coupled with placement of the gingival margin a short distance into the gingival sulcus, permits relatively atraumatic retraction procedures. A suitable diameter retraction cord is placed

in the gingival sulcus for eight to 10 minutes (Donovan, Gandara, Nemetz, 1985; Nemetz, Donovan and Landesman, 1984).

The cord is moistened with water prior to removal from the sulcus. Histological evaluation has demonstrated that removal of a dried cord from the sulcus tears the inner epithelial lining, initiates bleeding and may cause irreversible recession (Anneroth and Nordenram, 1969).

An improved retraction system, known as Traxodent (Premier Dental), is now available and yields outstanding results. It offers a convenient way to stop any crevicular seepage as it is impregnated with aluminium chloride and is combined with an absorbent clay base, which has an affinity towards oral fluid and blood. Ideally, it can replace the need for a second cord in the double cord technique as it lessens patient discomfort, displaces the tissue and eliminates the occurrence of breakthrough bleeding when removing the second cord.

#### Providing provisional restorations of excellent quality

The importance of fabricating quality provisional restorations cannot be overemphasised. These restorations may be made early in the restorative sequence as part of the healing phase or after the preparations are finalised. In either event, such provisionals must demonstrate physiologic crown contours and excellent marginal integrity and provide adequate aesthetics.

#### Eliminating all excess temporary cement

If all-ceramic restorations are planned, a non-eugenol cement should be used to prevent any inhibition of the polymerisation of the resin cement with eugenol contained in the zinc oxide eugenol cements (Rosenstiel and Gegauff, 1988).

**Figure 4:** These failed ceramic veneers were prepared without a finishing line and hence exhibit an emergence profile that is impossible for the patient to clean. The result is accumulation of plaque, chronic gingivitis and a margin that has moved cervically



If a conventional dental luting agent is to be used, such as glass ionomer or zinc phosphate, a zinc oxide eugenol temporary cement is preferred.

While it is now known that zinc oxide eugenol cements do not deaden pulpal tissues, they do provide an excellent initial seal of the prepared tooth. This tends to eliminate sensitivity during the provisional stage. However, zinc oxide eugenol is a potent soft tissue irritant, and care must be taken to ensure that all excess temporary luting agent is removed from the sulcus prior to dismissing the patient.

Any residual cement left in the sulcus will result in gingival inflammation. This inflammatory reaction is reversible upon removal of the irritant, but often a slight amount of recession will occur subsequent to the healing process. This recession, however slight, is detrimental to the long-term goal of hiding the margin beneath healthy tissue.

#### Waiting an appropriate time period to allow the tissues to heal after periodontal surgical therapy

When patients require periodontal surgical procedures such as crown lengthening, sufficient time must be allowed after the surgery to permit stabilisation of the gingival crest. It is often stated that a waiting period of six to eight weeks is required to attain adequate stability. However, for many patients, this time frame is far too short. In a majority of patients, a waiting period of five to six months is recommended (Wise,

**Figure 5:** Defining margins with tissue protected end cutting burs minimises iatrogenic periodontal insults



1985). It appears empirically that patients with thin, scalloped gingival tissues are more prone to recession than those with thick, flat tissues. This prolonged waiting period of five or six months would seem to be essential with the former type of patient, meaning that many patients will be wearing provisional restorations for protracted lengths of time.

It is recommended that such provisional restorations be removed and recemented approximately every six weeks to prevent leakage and subsequent recurrent caries.

#### Preventable techniques

To summarise so far, recession in association with the placement of anterior restorations is preventable. Attaining optimum soft tissue health prior to final determination of margin location is essential.

Atraumatic tooth preparation and gingival displacement procedures are required, along with the fabrication of excellent provisional restorations. A meticulous technique for provisional cementation is critical, and provision must be made for tissue shrinkage after periodontal surgical procedures.

#### Gingival inflammation

While exposing the recession of gingival margins has been a primary cause of aesthetic failure with metal-ceramic and all-ceramic restorations, an equally compelling problem is the chronic marginal inflammation in the gingival tissues associated with restorations with subgingival margins.

For many years, marginal inflammation was attributed to poor oral hygiene, and the patient was told to improve oral physiotherapy, usually to no avail. Highly polished metal margins or glazed porcelain margins are smoother and less conducive to plaque accumulation (Wise and Dykema, 1975).

Certain cervical marginal configurations have been demonstrated to be inherently rough, thus increasing the potential for plaque accumulation and retention. Therefore, they may contribute significantly to such marginal inflammation. The use of disappearing shoulder margins should be discouraged for this reason.

The primary causative factor with chronic gingival inflammation surrounding anterior restorations is violation of the biological width (Ingber, Rose and Coslet, 1977). It is tempting for the clinician, who is aiming to prevent margin exposure in the event of some gingival recession, to decide to place crown margins deep into the gingival sulcus. Placing the



**Figure 6:** These margins are exposed but the gingival health of this patient has been exemplary. The crowns are twenty years old and demonstrate physiological aging of the periodontium

margin deep into the sulcus creates difficulties with gingival retraction and increases the chance of irreversible damage leading to recession.

Clinical studies have demonstrated that the closer the restorative margin is to the attachment, the poorer the periodontal response is (Gargiulo, Wentz and Orban, 1961). The further the margin is from the attachment, the better the periodontal response is.

Specific recommendations have been made to place the restorative margins 0.5mm from the healthy free gingival margin, or more precisely, a minimum of 3mm from the alveolar crest (Block, 1987).

It is the opinion of the authors that the aetiology of the gingival inflammation seen in the majority of anterior crown restorations is biologic width violation, because margins are routinely placed too deep into the sulcus.

Often, this results from the clinician not



**Figure 7:** The two central incisors are implant-retained crowns and the periodontal health has been stable for many years. Placement of the fixture in the optimal labiolingual position is critical, as is the provision for correct emergence profile

following the anatomical sculpting of the gingival tissues, and the interproximal margins placed too close to the attachment.

While almost all authorities recommend supragingival crown margin placement, wherever possible, in order to obtain optimum soft tissue health (Silness, 1970), when crown restorations are needed, cervical margins are usually placed in an intracrevicular location, where it is usually impossible to blend in crowns imperceptibly with tooth structure when left supragingivally.

It is important to consider the patient's individual smile line and soft tissue display prior to determining the specific margin location when placing anterior restorations.

An important tooth shape criterion for an aesthetic smile is the symmetry of the maxillary anterior teeth (Fradeani, 2008). One excellent study demonstrated that as many as 25% of patients do not display the anterior gingival tissues with a normal or even an exaggerated

smile. This finding has significant clinical implications, because if patient consent is obtained, many anterior restorations can be placed with supragingival margins, which results in an improved periodontal response, better evaluation of marginal integrity, and substantially simplified operative procedures.

## Recall and maintenance programme

In summary, chronic marginal inflammation associated with anterior restorations can be prevented by placing crowns with smooth, precise margins in the proper intracrevicular position.

That position is quite a short distance into the sulcus (0.5mm) as measured from the crest of healthy gingival tissues. Margins must be a minimum of 3mm from the alveolar crest and patients must be instructed in and encouraged to perform optimum oral hygiene procedures. An appropriate recall and maintenance programme is vital.

No matter how natural and lifelike anterior restorations may be, the final aesthetic result is particularly dependent upon the health and level of the surrounding gingival tissues. The key to success is effective soft tissue management, and the goal of this soft tissue management has been to provide healthy gingival tissues covering sound, smooth restorative margins. Successful, meticulous attention to detail will result in clinical success regardless of the type of restoration chosen.

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