NQ Surgical Dentistry

Connective Tissue Grafts

This leaflet provides the reader with knowledge of the soft tissues found in the mouth, including their functions. It identifies the way in which tissue type is controlled and how, by surgical means, we are able to change the type of tissue growing around a tooth or implant, improving not only current soft tissue health and contour, but long term health of the soft tissue around both teeth and implants.

Finally, alternative techniques are outlined for the improvement of poor oral appearance resulting from localised and regional gingival recession. A number of different graft products used in this practice are also outlined.

Variation in tissues of the mouth

There are different types of soft tissue at different locations in the mouth; some are *thick, firm and robust* and others are *thin, elastic and fragile*. Each type of tissue performs different functions due to the variation in the features of each tissue.

The *thick, firm and robust tissue* found on the palate and generally around all teeth is known as *gingiva*. Gingiva is the tough, pale pink, and stippled soft tissue seen immediately next to the teeth. Its resilient nature is due to both the tissue's thickness and to its surface structure consisting a *keratin layer* that provides it with its tough character. This tissue is called *keratinised gingiva*. It encounters abrasion when we chew firm or hard foods and its toughness ensures it is not damaged when faced with such trauma.

The *thin, elastic and fragile tissue* seen around the mouth, *alveolar mucosa*, has a *high degree of elasticity allowing it to be stretched and move freely* without tearing. However it has no features offering protection against damage from the trauma of chewing. Instead it is thin and easily ulcerated having no resilient surface layer of keratin to protect it. It is therefore often referred to as *non-keratinised alveolar mucosa*.

What determines the type of tissue growing in any site?

The surface of tissue is made up of cells called **epithelium** and the deeper tissue beneath is called **connective tissue**. The type of tissue in any site depends of the genetic material found in the deepest layer of the epithelium (*basal cell layer*) and its supporting connective tissue beneath.

Genetic control of our tissues

Genetic material exists in every cell in the body. The genetic information determines what type of cell grows and what the cell does. Every characteristic of our body is pre-determined by genetic codes, from the colour of our hair, colour of our eyes, shade of skin, to the ways our

immune system functions. We are the product of the genetic codes that are handed down to us by our biological parents. These genetic codes are contained in our *deoxyribonucleic acid* (DNA) contained in the nucleus of each and every cell in our body.

What is a connective tissue graft?

A connective tissue graft is more accurately described as a "*sub-epithelial connective tissue graft*" (SCTG). "The graft" aims to transfer some of the deeper epithelium, the *basal cell layer*, and connective tissue, containing DNA from the *donor-site* (where the graft is harvested) to a *recipient-site* (where the graft is placed).

Once the graft integrates into the new recipient-site, and receives a new blood supply, the genetic codes of the DNA from the graft from the donor-site takes over control of the type of epithelial tissue growing at the recipient-site.

Keratinised versus non-keratinised tissue

Errors may occur in the formation of our bodies and these errors are described as *congenital defects*. Examples include clefts of the lips and palate. On a far smaller level, the normal anatomical arrangement of a keratinised band of thick, firm and robust gingival tissue surrounding a tooth can be congenitally absent, replaced instead by soft tissue consisting non-keratinised, thin, elastic and fragile alveolar mucosa. This tissue is more susceptible to damage and inflammation resulting in recession of the gingiva (gum recession).

Thick keratinised gingiva around a tooth is more resistant to inflammation and is far less likely to allow recession of the gum whereas at sites with non-keratinised mucosa, the likelihood of gingival inflammation developing and recession occurring is far greater.

The relationship between the type of tissue present and the likelihood of gum recession taking place applies to both teeth and dental implants. In fact, it has been shown that the risk of inflammation developing with resultant gum recession at a non-keratinised mucosal site is greatest around implants.

We can prevent gingival recession around teeth and dental implants

In an anatomical situation where fragile non-keratinised mucosal tissue is found next to a tooth or implant, a sub-epithelial connective tissue graft (SCTG) will re-programme the epithelium to change from thin alveolar mucosa at that site, to thicker, robust keratinised gingiva.

What are the benefits of a connective tissue graft?

A SCTG is considered the "*gold standard*" grafting procedure for the mouth where it is necessary to change thin tissue to a more robust type of tissue. It is a reliable and reproducible surgical procedure that achieves a lasting benefit providing more robust tissue

and minimising future gingival inflammation (gum disease), gingival recession, tooth loss, peri-implantitis or implant failure.

While the benefits of SCTG have so far been restricted to health and the prevention of future disease, there is a further benefit that may be important to some patients, that is the improvement in appearance. Where anterior natural teeth have suffered from gingival recession it can result in a poor appearance with uneven gum margins and areas of exposed root surface. This gingival recession may be either localised to a single or a couple of adjacent teeth, or it can be a more generalised problem affecting multiple teeth.

The appearance of patients suffering from gingival recession can be improved greatly by achieving coverage of the root surfaces, re-establishing a natural appearance with an attractive contour to the soft tissues around the teeth in the anterior region, described as the smile line.

Alternative procedures and materials used to achieve root coverage

The SCTG described earlier in this leaflet uses the patient's own connective tissue, harvested from within the palate, to genetically re-direct the formation of the tissue. The SCTG is generally regarded as the most effective and reliable of the grafting procedures and frequently referred to as the "gold standard" of oral grafting. Other approaches have been successfully developed to improve the physical features of the tissue, primarily thickness, to improve its resistance to disease or recession.

All approaches involve a series of similar surgical techniques and implantation of a variety of different graft materials. While SCTG used the patient's own tissues described as an *autograft*, it is possible to use alternative materials.

An alternative form of graft material is an "*allograft*" that has been harvested from another human donor and treated in various ways to render it safe and then dried for storage. It can later be re-hydrated ready for use. In this practice the only allograft used is provided by BioHorizons and is known as *Alloderm*. It is successful for use in reliably achieving root coverage of natural teeth using highly technical micro-surgery. However, in the opinion of Dr Priestland, it does not appear to achieve such reliable results around dental implants. It is never used without the full knowledge and agreement of the patient.

A further alternative is the use of material derived from an animal other than a human. This is a "*xenograft*" and generally involves the use of material harvested from a cow (*bovine*) or pig (*porcine*) model. Bovine and porcine collagen-based materials are commonly used for both soft tissue and bone replacement grafts. Following suitable treatment and preparation, these graft materials appear to be well tolerated by the human recipient. Geistlich, a Swiss company have developed a number of different grafting materials with a variety of applications.

In order to increase tissue thickness, and an increase in the width of the band of keratinised gingiva, a porous, porcine-derived collagen-based grafting material is used to insert into the deficient site. It must be placed within the pre-existing bounds of the existing keratinised gingiva, ensuring the original keratinised tissue remains around the entire edge of the graft material inserted. The marginal keratinised tissue can migrate into the graft material regenerating additional keratinised band width. Such a material produced by Geistlich called *Mucograft*, is achieving reliable outcomes following treatment in this practice. The graft is left

open to the oral cavity and acts as a scaffold around which the cells derived from the surrounding tissues migrate and multiply producing an increased quantity of the original keratinised tissue.

Geistlich has also developed another collagen-based product that is far thicker than Mucograft. This highly dense and thick graft is called *Fibrogide*. This porous, and volume stable graft material can be carefully pre-shaped using a scalpel blade. It is then placed in the site where the tissue is too thin. The graft must be stabilised to prevent movement and then covered by the pre-existing thin tissue flap of gum. The Fibrogide promotes the formation of new blood vessels and will provide the required scaffold for the creation of a thicker connective tissue. However, it will not carry the DNA genetic direction to change the epithelium from non-keratinised to keratinised. It aims to change the physical type of tissue from thin to thick, not change the type of epithelium.

The benefits of using all these various grafting materials including Alloderm, Mucograft and Fibrogide includes reduced surgery time with no need for a second surgical site in the palate to harvest a piece of graft tissue. Reduced surgery means the treatment time is reduced, post-surgical discomfort is reduced, and there are less surgical sites where post-surgical infection can occur.

This leaflet is written to give the reader some understanding of what can be achieved and the highly scientific nature of such products and surgical techniques. The Therapeutic Goods Administration approves all materials used in this practice for use in Australia. There are many materials available around the world, but not all achieve reliable success and many have insufficient scientific data supporting their success and safety.