THE
WILCKODONTICS™ SYSTEM
AN OVERVIEW

To help understand the goals of the WILCKODONTICS™ system, a cursory review of the bone that supports the roots of the teeth is in order. The bone of the jaws is similar to the long bones in ones arms and legs in that there is a hard outer shell (the cortical plate) and a softer interior (the medullary bone). **Figure 1** shows a cross section of a long bone.

Color Key for ALL Diagrams

- Medullary Bone
- Gum
- Bone Grafting Material
- Cortical Plate

Figure 1

The medullary bone has a good blood supply and is highly populated with pluripotential cells that can resorb old bone and make new bone. It is this very vital nature of the medullary bone which gives it the ability to respond in a dramatic and timely fashion to a physical insult, such as the forces used to move teeth. Conceptually, it would make sense that the roots of the teeth should move rapidly since they extend down into the jawbone and would seemingly be surrounded by the softer and more vital medullary bone. **Figure 2** shows a cross section of an upper front tooth in a conceptually ideal situation.

Unfortunately, the root of the tooth is usually so large in diameter that it takes up most of the space between the inside and outside harder cortical plates especially in the front of the mouth. This leaves little, if any, room for the soft inner medullary bone. This results in much of the root being covered with the hard cortical plates and very little soft medullary bone (**figure 3**). Compared to medullary bone, the cortical plates have a greatly reduced blood supply and a negligible population of pluripotential cells. This greatly reduces the cortical plates' ability to remodel in a timely fashion.

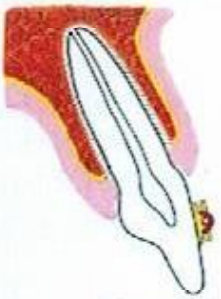

Figure 2

Figure 3

To move a tooth, the root of the tooth needs to be moved through the jawbone that surrounds it. Theoretically, this is made possible by the bone resorbing on the pressure side of the root surface (the direction in which the tooth is being moved) and by new bone forming on the tension side of the root surface (the direction away from which the tooth is being moved). To maintain the same initial thickness of jawbone on the inside and outside of the root, the corresponding inner and outer surfaces of the jawbone need to thicken and thin respectively as shown in **figure 4**. The arrows indicate the direction in which the tooth is being

moved. The dots indicate the areas where the bone is being resorbed and the dark areas indicate where the new bone is being formed.

Unfortunately, when a tooth is moved a significant distance, there is a tendency to lose the layer of bone over the inside and outside surfaces of the root, especially in the direction in which the tooth is being moved and more so near the necks of the teeth where the root is usually widest in diameter (**figure 5**). In other words, in the direction the tooth is being moved the root is literally pushed into a position outside the periphery of the jawbone. The arrows indicate the direction in which the tooth is being moved.

Figure 4

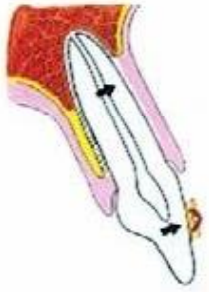

Figure 5

This is obviously more of a potential problem when the teeth are overlapped and crowded as shown in **figure 6**. To correct the crooked alignment of these teeth, the teeth need to be expanded toward the outside of the jaw to make more room for them. The arrows in **figure 6** indicate the direction in which the teeth will be moved. **Figure 7** shows the teeth after they have been straightened.

Figure 6

Figure 7

Often in a crowded situation where a tooth is positioned very prominently (sticks out), there is a lack of bone over the outside of the root surface even prior to any orthodontic work. That is, the prominent root surface is already situated outside the periphery of the jawbone. If this prominence is severe enough, the gum over the root may even appear stretched and thin (**figure 8a,b**). It is this lack of bone and thin gum over a prominent root surface that can especially predispose an area to recession of the gum.

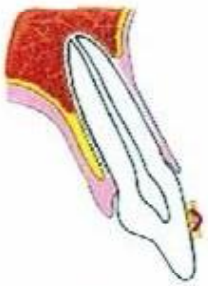

Figure 8a

Figure 8b

Figure 9 shows crowded upper front teeth prior to orthodontic work.

Figure 10 shows these same upper front teeth immediately following the completion of orthodontic therapy. These teeth were expanded toward the outside of the upper arch. This expansion made it possible to line the teeth up straight.

Figure 11 shows these same upper front teeth several years following the completion of the orthodontic work. Gum recession has occurred over the prominences of the roots where there is a lack of bone. Trauma, such as improper brushing, can help precipitate gum recession in this type of situation. Likewise, poor oral hygiene and a resulting accumulation of bacterial plaque along the gum line can aggravate the situation. The root surfaces over the prominences of the roots are now visible where the gum has receded.

Figure 9

Figure 10

Figure 11

Figure 12 shows bone missing over the prominence of the root of an upper eyetooth in a dried skull.

Figure 13 shows severe gum recession on the outside surface of the root of an upper eyetooth.

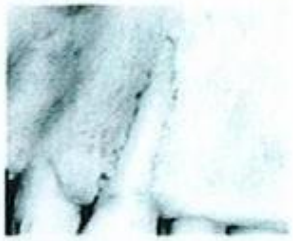

Figure 12

Figure 13

Figures 14a,b,c, show gum recession in a young individual several years following completion of conventional orthodontics.

Figure 14a

Figure 14b

Figure 14c

As already mentioned, two predisposing factors to gum recession are a lack of bone over the prominence of the root and a thin collar of gum over the neck of the root. Conventional free gum grafting was developed many years ago. It is designed to create a thicker collar of gum over the neck of the root. The thick gum utilized for the grafting is generally taken from the palate (the roof of the mouth). If a tooth is positioned very prominently the collar of gum around the neck of the root is often very thin and there is a great likelihood that the bone is missing over the most prominent portion of the

root. To help lessen the likelihood of gum recession free gum grafting can be performed. If this situation exists prior to orthodontic work as shown in **figure 15a**, free gum grafting can be performed before the tooth movement begins as shown in **figure 15b**. This thicker gum will lessen the likelihood of gum recession during the orthodontic work but it will not eliminate the possibility of gum recession since there is still most likely bone missing over the prominence of the root.

Figure 15a

Figure 15b

If gum recession occurs while orthodontic work is in progress, free gum grafting can be done at that time or immediately following the completion of the orthodontic work. Please remember that conventional free gum grafting was not designed to cover the root surface that has become exposed. **Figures 16a,b** show a case before and after free gum grafting was performed during conventional orthodontic work. **Figures 17a,b** show a case before and after free gum grafting was performed following the completion of conventional orthodontic therapy.

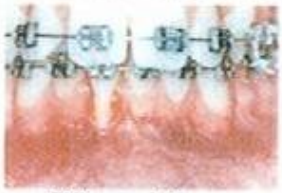

Figure 16a

Figure 16b

Figure 17a

Figure 17b

If gum recession occurs on the outside of any of the upper teeth following the completion of the conventional orthodontic work and is an aesthetic problem, another type of gum grafting can be utilized to attempt to cover the exposed root surface. Figures **18a,b** demonstrate this in a teenage girl immediately following the completion of the orthodontic work.

Figure 18a

Figure 18b

Another type of gum shrinkage that is a potential problem in both adolescents and adults following orthodontic therapy is referred to as papillary shrinkage. The triangular shaped piece of gum between two teeth is called the interdental gum papilla. Often following orthodontic therapy this

papilla appears to shrink leaving space between itself and the two teeth between which it sits, especially in adults. Even though there is some elasticity to the gums, the tough collar of gum around the necks of the teeth tends to maintain a fairly constant volume and this includes the interdental papilla. One situation in which the likelihood of seeing papillary shrinkage is rather high is where two teeth are badly overlapped leaving room for only a small papilla between them as shown in **figure 19a**. When the two overlapped teeth are straightened the papilla is too small to fill the larger space that has been created between the two teeth as shown in **figure 19b**.

In younger individuals the necks of the teeth are usually rather close to the surface of the jawbone as shown in **figure 20, line A**. Generally in older individuals the surface of the bone is not as close to the necks of the teeth even in a healthy situation as shown is **figure 20 line B** . The further the surface of the bone is from the necks of the teeth the more likely one is to see some degree of papillary shrinkage following orthodontic therapy as shown in **figure 20 line C**. This is the major reason that papillary shrinkage is more of a potential problem in adults rather than in adolescents, especially if the adult has lost bone due to periodontal disease (pyorrhea).

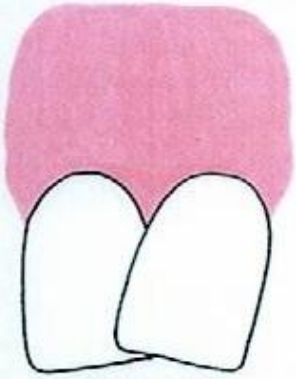

Figure 19a

Figure 19b

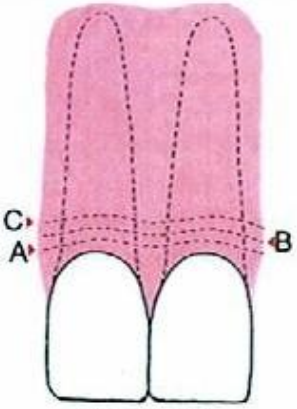

Figure 20

Figures 21a, b, c, d show papillary shrinkage in a 26 year old female following conventional orthodontic therapy. If you look closely you can see some debris on the tooth surfaces along the gum line in the areas of the papillary shrinkage. Poor oral hygiene and the resulting accumulation of bacterial plaque along the gum line can also contribute to papillary shrinkage. If the papillary shrinkage is minimal, its impact can be lessened, but not completely eliminated by removing some of the enamel from the sides of adjacent crowns as shown in **figure 22a**. The arrows indicate the direction in which the crowns are then moved. This essentially results in squeezing and plumping up the papilla as shown in **figure 22b**.

Figure 21a

Figure 21b

Figure 21c

Figure 21d

Figure 22a

Figure 22b

Another type of gum problem that can complicate orthodontic work is literally "too much" gum. Certain medications can contribute to this problem, but generally it is nothing more than an alteration of a natural process referred to as passive eruption. As a permanent tooth erupts into the mouth it tends to carry the gum with it. At times when the crown of the tooth has completely erupted through the bone it is still partially covered with the tougher collar of gum. Over a relatively short period of time this collar of gum should shrink back to the neck of the crown so that the crown then looks normal in appearance (the correct length). If this tough collar of gum does not shrink back to the neck of the crown of the tooth, the resulting situation is referred to as "altered passive eruption." The altered passive eruption (extra gum) can be reduced prior to orthodontic work. This may facilitate the orthodontic work. **Figure 23a** shows altered passive eruption in an adolescent prior to orthodontic work. **Figure 23b** shows the same case following the removal of the extra-gum and at the beginning of the orthodontic work.

Figure 23a

Figure 23b

The extra gum can also be removed following the completion of the orthodontic work. Moving teeth that are surrounded by extra gum is rather tedious and maintaining the teeth in their final position can also be difficult. **Figure 24a** shows an adolescent toward the end of orthodontic therapy with a significant amount of extra gum present. **Figure 24b** shows this same case approximately 6 months following the removal of braces. Even with good oral hygiene on the patient's part, there has been no significant shrinkage of the extra gum. **Figure 24c** shows the same case following the removal of the extra gum. In this particular situation, removing the extra gum also did away with the appearance of a "gummy smile." If a significant amount of extra gum is left in place following orthodontic work, it is more difficult for the patient to clean the teeth and this can predispose the patient to periodontal disease (pyorrhea). If the patient's oral hygiene is less than adequate, the extra gums can also swell and move the teeth leading to relapse (the teeth become crooked again).

Figure 24a

Figure 24b

Figure 24c

Figures 25a,b,c show a 14 year old girl following the completion of the orthodontic work and prior to the removal of the extra gum.

Figures 26a,b,c show the same 14 year old girl following the removal of the extra gum

Figure 25a

Figure 25b

Figure 25c

Figure 26a

Figure 26b

Figure 26c

If extra gum is not removed prior to orthodontic work and if the patient's oral hygiene is lacking, the extra gum can swell and cover the braces making it impossible to proceed with the orthodontic work as shown in **figure 27a**. **Figure 27b** shows the same case following the surgical removal of the extra gum and prior to recommencing the orthodontic work.

Figure 27a

Figure 27b

As already mentioned, the roots of the teeth move more slowly through the harder cortical plates and more rapidly through the softer medullary bone. After the early teen years, the blood supply to the cortical plates tends to decrease and the cortical plates tend to thicken which can further slow tooth movement. With aging, the medullary bone also becomes less vital (a decreased blood supply and smaller marrow spaces) that will likewise also slow tooth movement as shown in **figure 28**.

Figure 29 shows an extreme case of thickening of the cortical plates in an adult.

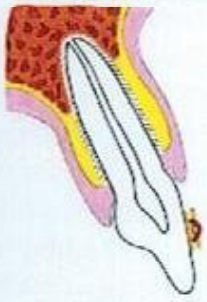

Figure 28

Figure 29

One especially undesirable problem that can accompany orthodontic therapy is referred to as "root resorption." As a consequence of root resorption one might begin orthodontic therapy with long roots(**figures 30a, 31a, 32a**) and end up with shorter roots(**figures 30b, 31b, 32b**). Root resorption can occur at any age, but is certainly more of a potential problem in older individuals. The changes within the bone that occur with aging make it less accommodating to tooth movement. This significantly increases the risk of root resorption; the roots of the teeth may tend to resorb faster than the bone around them.

Figure 30a

Figure 31a

Figure 32a

Figure 30b

Figure 31b

Figure 32b

The WILCKODONTICS™ system was developed to permit safe and rapid movement of the teeth and to achieve a stable result. To facilitate the movement of the roots of the teeth through the surrounding bone, we utilize a periodontal bone activation technique. This technique varies somewhat depending on the type of tooth movement we are trying to achieve and a couple of variations will be presented. It is the bone activation that also lessens the potential for root resorption. As mentioned earlier, we would like to believe that as a tooth is being moved, that the bone support over the inside and outside surfaces of the root is being maintained by the proper coordination of the removal of old bone and the formation of new bone to take its place. This however, does not happen as predictably as we would hope and especially if a tooth is being moved more than just a minimal distance. Often at the completion of the orthodontic therapy bone has been lost over the prominences of the roots especially over the surface of the root that faces the direction in which the tooth is being moved. To lessen the impact of this likelihood, we attempt to create a situation in which new bone can form over the prominences of the roots following the completion of the orthodontic work. We can accomplish this by placing various bone grafting materials over the prominences of the roots that in time converts to the patient's own natural bone. The process by which the body converts the grafted materials into natural bone is referred to as "bone regeneration." Bone regeneration in the past was typically used to try to re-grow bone that was lost due to disease or atrophy. Replacing bone that has been lost due to tooth movement is a new application for this process. By trying to ensure an adequate bone support for the roots of the teeth following orthodontic work we hope to increase the long-term stability of the finished case and lessen the likelihood of severe gum recession. As stated earlier, the gums tend to recede when

there is a lack of bone over the prominences of the roots of the teeth. The bone regeneration works optimally around the upper teeth, but also works well around the lower teeth. With the bone regeneration we also attempt to re-grow bone over prominent root surfaces that were lacking in bone even prior to the orthodontic work.

The WILCKODONTICS™ system is applicable in expansion and retraction cases. Its use will now be briefly described in each of these two situations.

The periodontal bone activation is especially helpful when overlapping teeth are being expanded within the arch(pushed toward the outside of the arch) to eliminate the overcrowding. This can often lessen the need for extracting teeth which in certain situations leads to a weak profile following treatment. **Figure 33a** shows a normal profile and **figure 33b** shows a weaker profile.

Figure 33a

Figure 33b

Figures 34a,b shows the upper anterior teeth after bracketing.

Figure 34a

Figure 34b

Figures 35a,b show the gums reflected to expose the harder cortical plates.

Figure 35a

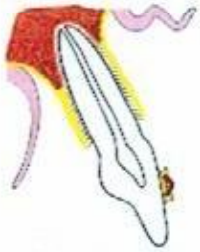

Figure 35b

Figures 36a,b show various combinations of grooves and perforations that have been made in the cortical plates to initiate the bone activation phase. Certain principles need to be followed and it is unlikely that the preparations will be exactly the same in any two cases. It is the periodontal bone activation that enables the cortical plates to remodel rapidly and in turn permits the roots of the teeth to be moved quickly through the bone. This stimulated rapid remodeling process also lessens the likelihood of substantial root resorption. The periodontal bone activation works by creating bleeding points and communications with the softer interior medullary bone. These communications act as pathways through which new blood vessels and pluripotential cells can migrate from the medullary

bone and into the cortical plates. As mentioned earlier, the pluripotential cells can remove old bone and make new bone. This essentially makes the cortical plates more vital and able to readily respond to the forces of tooth movement in an adequate fashion.

Figure 36a

Figure 36b

Figures 37a,b show the grafting materials after they have been applied to the surfaces of the periodontally activated cortical bone.

Figure 37a

Figure 37b

Figures 38a,b show the gums sutured back into their original position. The bone grafting materials now rest between the outer surface of the activated cortical plates and the inner surface of the gums. It is the pluripotential cells that will, over a period of time, remove the bone grafting materials and replace them with the patient's own natural bone. If as a result of the tooth movement the prominences of the roots are pushed through the periphery of the jawbone or if for any other reason there is a lack of original bone over the prominences of the roots following the orthodontic work there is now the potential for the body to create new bone over the prominences of the roots. If we can maintain adequate bone support for the teeth there should be less likelihood of relapse or periodontal breakdown such as gum recession.

Figure 38a

Figure 38b

Retraction cases are handled somewhat differently than expansion cases. Retraction implies that a segment of teeth needs to be moved toward the inside of the mouth. A somewhat oversimplified example of this would be correcting "buck teeth," that is where the only significant problem is that the upper front teeth stick out too far (**figures 39a,b**).

Figure 39a

Figure 39b

In the context of this particular example, extraction of teeth is needed to make room for the teeth that will be retracted. **Figures 40a** and **41a** show the upper teeth prior to the extractions and **figures 40b** and **41b** shows the upper teeth following the extractions.

Figure 40a

Figure 40b

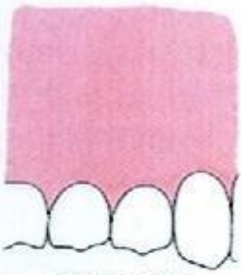

Figure 41a

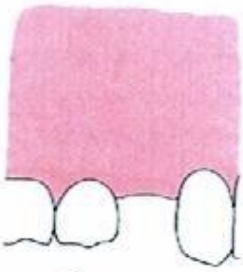

Figure 41b

As in the expansion cases, the cortical plates must be periodontally activated prior to the application of the grafting materials. To accomplish this, the gums are reflected as shown is **figure 42a**. The cortical preparations are significanly different in the retraction cases to allow room for the segment of the front teeth to be moved back into the mouth. In particular, a groove is placed on the inside of the upper front teeth as shown in **figure 44a** and extended to include the entirety of the extraction sites as shown in **figure 42b**. The grafting materials are then placed over the the activated bone. **Figure 43a** shows the grafting materials after being placed in an extraction area. **Figure 43b** shows this same area after the gums have been sutured back into their original position. **Figures 44b** and **45a,b** show the upper front teeth at the same surgery after the grafting materials have been placed over the activated bone and after the gums have been sutured back into their original position (primary closure). This primary closure facilitates the healing process and makes for a very tolerable recovery period.

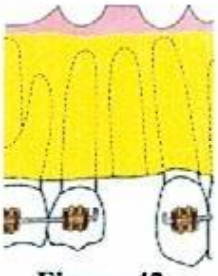

Figure 42a

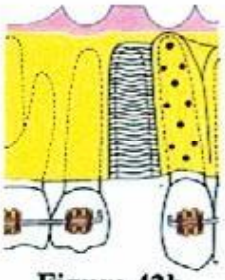

Figure 42b

Figure 43a

Figure 43b

Figure 44a

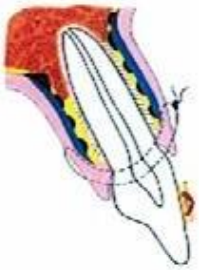

Figure 44b

Figure 45a

Figure 45b

Figure 46a shows the upper front teeth prior to being moved back toward the inside of the mouth and **figure 46b** shows the upper teeth after most of the retraction process has been completed.

Figure 46a

Figure 46b

With the WILCKODONTICS™ system emphasis is placed on the quality of the completed case. By activating the bone there is a temporary decrease in the hardness of the bone and increase in cellular activity within the bone. This lessens the likelihood of substantial root resorption especially in adults where the bone is typically less vital than in adolescents. Consequently the teeth can be moved through the bone both rapidly and safely. Bone grafting is performed in conjunction with the bone activation to strive to maintain the integrity of the jaws. If the height of the bone can be maintained over the prominences of the roots, there is less likelihood of seeing significant gum recession. If there is bone missing over the prominences of the roots prior to treatment, an attempt is made to regenerate it but there is no guarantee that this will be successful. Another very important reason for doing the bone grafting is to have additional support for the lips in the completed case thus creating a more stable result.

The WILCKODONTICS™ system does not lessen the likelihood of papillary shrinkage between the teeth. This still needs to be addressed with plumping up of the papilla by removing some enamel on the sides of the crowns prior to the completion of the orthodontic work. If this is not sufficient to close the spaces, bonding by your general dentist may be another consideration.

With the WILCKODONTICS™ system treatment times can be dramatically reduced. The patient needs to be seen approximately every two weeks, but the number of adjustment appointments is still decreased in comparison to conventional orthodontics. Because of the relatively short treatment times a patient may be able to complete a significant amount of the work during a more convenient period of time such as summer vacation. The much shorter treatment times also lessen the negative social implications associated with wearing braces for long periods of time. The longer an individual has to wear braces, the more likely he or she is to encounter such problems as orthodontic appliance breakage, decay, gum infections and swelling. A much shorter treatment period should significantly reduce these potential complications.

One could argue that the surgical portion of the treatment is a "down side". Quite frankly, many orthodontic cases already involve surgery. These surgeries could include: removing some teeth to make room for other teeth, removing impacted wisdom teeth, exposing impacted teeth that need to be pulled into proper position in the mouth, orthognathic surgery to address improper positioning or jaw size, gum grafting in relationship to potential gum recession, removal of extra tough gum (altered passive eruption), etc. The surgical portion of the WILCKODONTICS™ treatment is done under local anesthesia so that the patient will feel no pain. Different types of sedation can be used in additional to local anesthesia to keep the patient relaxed and comfortable and to make the time pass quickly. There is usually discomfort (soreness) when the anesthetic wears off. The discomfort is typically minimal in nature because of the "primary closure." This means that the gums are returned to their original position and that no areas are left opened or exposed. The amount of post-operative discomfort varies from patient to patient and pain medication can be prescribed if needed.

BRIEF REVIEW OF MAJOR POINTS

A) The WILCKODONITCS™ system is designed to move teeth very rapidly. It is applicable to the majority of orthodontic cases, but not all orthodontic cases. Your orthodontist will know if this approach is applicable in your situation.

B) The WILCKODONTICS™ system may lessen the likelihood of severe root resorption, but it will not eliminate the possibility of root resorption.

C) The WILCKODONTICS™ system may lessen the likelihood of severe gum recession, but it will not eliminate the possibility of gum recession.

D) The WILCKODONITCS™ system will not decrease the likelihood of papillary shrinkage between the teeth. If this occurs, it still needs to be addressed by removing some of the enamel from the sides of the crowns of the teeth just prior to the completion of the orthodontic work. Depending on the shape of the teeth and the size of the spaces, bonding by your general dentist may be another consideration.

E) With adequate bony support for the roots of the teeth and additional bony support for the lips the completed case should be relatively stable. There is, however, no guarantee that relapse won't occur.

YOUR COOPERATION IS ABSOLUTELY ESSENTIAL! YOU CANNOT MISS APPOINTMENTS! After the bone has been activated, there is a window of opportunity during which time the majority of the orthodontic work must be completed. Once the window of opportunity closes, the movement of the teeth slows and the case essentially reverts back to a conventional orthodontic case.

If you still have reservations after reading this brochure and discussing any questions, you should opt for conventional orthodontics rather than the WILCKODONTICS™ system.