Perio sheet 7

**Regenerative surgery**

The aim of this surgery is to transfer the patient from disease state to more healthy status.

You should reach with your patient to acceptable level of oral hygiene to be able to do the surgery.

So, such kind of surgery need **induction of behavior change.**

Using **treatment modalities** such as scaling and root planning, maintenance therapy, and antimicrobial therapy, this will help us to control the pathogenic microflora to prevent further periodontal destruction.

Sometimes despite successful disease management, anatomic changes resulting from past disease activity often occur and must be corrected. Why? Because if they were left untreated, (even with prober oral hygiene) these defects can provide a potential harbor for the reestablishment of a pathogenic microflora and future risk of

future disease. These areas; such as **class 3-furcation invasion, deep intrabony defect.**

* **How can I manage a persisting defect?**

in cases with persisting deep pockets, **surgical procedures** should be undertaken to clean the root surfaces.

* **Surgical procedures therapy:**
1. **Open flap debridement:** a flap is elevated to expose root surfaces and clean them by removing all calculus and granulation tissue. But this will leave the bone defect.
2. **Osseous resective surgery:** procedure involves osteotomy and osteoplasty to remove shallow vertical bone defects. ( not possible in cases with deep vertical defects because a lot of tissue loss will result from removing the deep defect)
3. **Regeneration:** the ideal surgical treatment modality in cases with deep vertical bone defects.

So, non-surgical procedures won’t be enough for deep pockets because they will leave bone defects which will recolonize bacteria again.

**Principles of regenerative medicine**

The idea is to replace bone with bone not with prosthetic devices.

The aim of regenerative medicine is to get rid of all this metallic prosthesis; because they do not provide us with the ideal treatment.

**Regeneration**: The reproduction or reconstruction of a lost or injured part.

Periodontal regeneration implies the formation of new cementum with inserting collagen fibers and bone.

**Repair:** The situation in which healing does not completely restore the architecture or the function of the lost tissue or parts.

**­Periodontal repair may include:**

1. Formation of a long junctional epithelium
2. Connective tissue attachment
3. Ankylosis.

For a process to be considered regeneration, the tissue has to go back to the way it was anatomically and physiologically before the disease as if the disease never took place.

Normally collagen fibers are inserted **perpendicularly** to the surface of the root.

In repair, collagen fibers will be inserted **parallel** to the root surface.

* **Why is regeneration not achieved in some cases?**

Because of the difference between the tissue.

Epithelium has the **highest tendency** to fill the space created by tissue loss, since it has the **fastest growth rate**.

If epithelium couldn’t then **connective tissue** will and if they CT couldn’t then **bone** depending on the growth rate.

**Cementum** is the tissue that grows at the slowest rate among the four tissue types.

**Epithelium migration needs basement membrane, so it happens below the clot not above. And under the granulation tissue. (viva question)**

**Epithelium is the fastest due to its function that is protection**

Because of the presence of these four different tissues that are competing on the same space created by tissue loss, there are 4 possibilities to end up with (as mentioned above):

1. Formation of a long junctional epithelium
2. Connective tissue adhesion accompanied by some degree of root resorption and insertion of connective tissue fibers parallel to the root surface.
3. Root resorption and ankylosis. In this case, bone is in direct contact with the root surface.

 **The first three points are considered repair.**

1. Regeneration, which involves the formation of new bone, cementum, epithelium, and connective tissues in the correct proportions. (cementum cannot regenerate itself, its regenerative cells present in pdl).

If the regenerative procedure was not successful, repair will take place with a combination of the first three.

Epithelium migrates apically with the help of the connective tissues. Once it migrates apically and produces a **long junctional epithelium** to occupy the defect on the root surface, it will cover the root surface and **prevent the regeneration of the proper periodontium**.

Clinically it is impossible to tell the difference between regeneration and repair by **probing.** Repair and regeneration can only be differentiated **histologically.**

**The process of regeneration includes**:

Epithelial migration and maturation which takes place first as it is the fastest, followed by connective tissue formation (collagen fibers), and then revascularization takes place. Bone resorption takes place within the first 21 days, and bone formation starts during the first 2 to 4 weeks. Bone maturation needs more than 2 years to occur. Epithelium maturation happens after 42days that is why we give 8 weeks as time of reevaluation of non-surgical therapy (after root planning).

This shows that regeneration is a dynamic process and it depends on many factors. **The two most important factors are**:

1. The chemical stimuli that are present in the area.
2. Metabolism.

**Techniques used to achieve regeneration**

1. **Root conditioning procedures:**

The two agents that have been studied the most regarding root conditioning are:

 (a) EDTA in low concentrations.

 (b) Tetracycline.

Their use was proved in in-vitro models and in animal studies. However, in all the human studies except one case report, the results were negative.

1. **Bone grafts and bone substitutes:**

Bone can be grafted using bone or bone substitutes. Any graft material other than autogenous bone is considered a bone substitute.

Because bone is a tissue and by definition, a tissue contains vessels, cells, growth factors, and matrix and autogenous bone is the only graft material that contains all these components.

1. **Guided Tissue Regeneration:**

This concept involves the guiding of the regeneration of tissues according to their rate of turnover.

1. **Biologic and biomimicry mediators:**

It involves the use of certain growth factors that will target such cellular activity which will help to induce a certain step of the regenerative process.

The regenerative process has three main requirements that:

1. Regenerative space: the space created by the bone defect needs to be maintained. Or it will be occupied within 14 days.
2. Signaling molecules: meaning growth factors
3. Stem cells: (progenitor cells) ((major player)).

**Assessment of wound healing**

Wound healing can be assessed in one of the following ways:

* Probing depth:

**(not a reliable)** probing depth relies on the level of inflammation of the gingiva at the time of probing.

* Clinical attachment level:

 **(more reliable than the probing depth; however, it is not completely reliable)**. involves the measurement of the amount of gain in attachment by evaluating the difference between the postoperative probing depth and the pre-operative probing depth.

* Bone fill:

this can be assessed by several methods:

**Surgical re-entry** to the area and visually assessing bone formation

**Taking reproducible parallel technique radiographs** to assess bone formation

Anesthetizing the gingiva locally followed by **bone sounding** (probing the bone through the gingiva)

Advantage: 1- minimal invasive 2- indication (what happen) 3-quantifying (somehow)

Disadvantage: I do not know where is the attachment happen.

* Histological analysis

**This is the only method that can reliable.**

**Bone Grafting Materials**

can be autogenous, allogenous, xenogenous, or alloplastic materials.

They can be:

1. Osteogenic: the graft material itself produces the new bone. **(the best material)**
2. Osteoinductive: the graft material induces bone formation in an ectopic site through chemical factors.
3. Osteoconductive: the graft material acts only as a mechanical scaffold for cells to migrate and form bone.

Theoretically, bone graft materials should be resorbable. The rate of resorption should coincide with the rate of natural bone formation. But there is discrepancy in the resorption in some areas.

The reason for this discrepancy in resorption is not related to the graft material itself; it is related to the difference in oxygen availability between different areas of the graft. The stem cells that attach to the bone substitute have special properties. One of their most important properties is their ability to support hypoxia for up to **7 days.**

**An ideal regenerative material should include cells, a scaffold, and signaling molecules.**

**Autogenous bone grafts:** Sources for autogenous grafts can be either

intraoral or extraoral.

* **Extraoral** sources include flat bones such as the iliac crest.
* **Intraorally** taken from edentulous ridges, maxillary tuberosities, mandibular ramus, tori and exostoses, and the anterior mandible.

**The disadvantage of intraoral graft** materials compared to extra oral sources is that the intraoral grafts have a higher proportion of cortical bone.

**Iliac bone** is the best material available for bone grafts regarding physiology and biology due to its **ideal** **structure**. iliac bone

can achieve a bone fill of up to 4 mm.

***Iliac bone and DFDBA (discussed below) are the only graft materials that can achieve regeneration of periodontium in cases with horizontal bone loss (zero wall defects) ((reported evidence)).***

**Allogenous:** bone grafts contain a scaffold and signaling molecules; they lack stem cells.

They are osteoinductive.

There are two types of allogenous bone grafts:

* **DFDBA** (demineralized freeze dried bone allograft) (deminaralized = signal molecule).
* **FDBA** (freeze dried bone allograft) (dried=no fluid) (freeze=to protect it).

Theoretically, the disadvantage with these allografts is the probability of disease transmission between patients. But never reported any incidence.

DFDBA (demineralized) is a better option because it is more easily resorbed and release of bone morphogenic proteins from FDBA is easier.

as we said before DFDBA has been shown to regenerate bone in cases with horizontal bone loss.