

## Gingival crevicular fluid (GCF)

It is an inflammatory exudate that can be collected at the gingival margin or within the gingival crevice. It can be found in the physiologic space (gingival sulcus). As well as in the pathologic space [gingival pocket, called (transudate) or periodontal pocket, called ( exudate) ] between the gingiva and teeth

- GCF is derived mainly from plasma and secreted from gingival vessels which exhibit pathologically increased permeability, it releases through gingival sulcus or periodontal pocket
- GCF is continually secreted from the gingival connective tissues into the sulcus through the sulcular epithelial wall
- It is found in small amounts in clinically healthy gingival sulci and increase in the presence of inflammation

The presence of GCF in clinically normal sulci, despite that it is considered as an inflammatory exudate, it can be explained by the fact that it exhibits inflammation when examined microscopically

## Functions

Sulcular fluid is believed to contribute to gingival defence mechanism by:

- 1- Washing the crevice carrying out the shed epithelial cells, leukocytes, bacteria and debris
  - 2- Having plasma proteins, which may influence epithelial attachment to tooth
  - 3- Containing antimicrobial agents, lysozymes, PMNLs, macrophages and immunoglobulins
- **The constituents** of GCF originate from serum, gingival tissues, bacterial and host response cells
  - The biochemical analysis of the fluid offers a non invasive means of assessing the host response in periodontal disease
  - Active phase of periodontal disease process can be measured or assessed by constituents of gingival fluid. Bacterial enzymes, bacterial degradation products, connective tissue degradation products, host mediated enzymes, inflammatory mediators, extracellular matrix proteins either together or individually can be detected in higher levels in gingival crevicular fluid during active phase of periodontitis

- These analyses mainly focus on **inflammatory markers**, such as prostaglandin E2, neutrophil elastase and beta-glucuronidase, in addition to the cellular necrotic markers (aspartate aminotransferase)
- The analysis of inflammatory markers in the GCF may assist in defining how certain systemic disease (e.g., diabetes mellitus) can modify periodontal disease and how periodontal disease can influence certain systemic disorders (atherosclerosis, preterm delivery, diabetes mellitus and some chronic respiratory diseases)
- Major factors which influence the results obtained from the analysis of GCF are not only the methods of these analysis, but the method of GCF collection as well

### Methods of collection of GCF

Collection of GCF is a non-invasive and relatively simple procedure, so we have several methods for the collection of GCF from the gingival sulcus:

#### 1- Gingival washing method

- In this technique the gingival crevice is perfused with an isotonic solution of fixed volume such as balanced salt solution
- The fluid collected then represents a dilution of crevicular fluid
- The simple method of this technique involves the ejection and aspiration of a known amount of solution into a given interdental gingival crevice by using needle of 50 microliter (micro syringe)

## 2- Capillary tubing or micropipettes

- Following the isolation and drying of a site, capillary tubes of a known internal diameter are inserted into the entrance of the gingival crevice
- GCF from the crevice migrates into the tube by capillary action and because the internal diameter is known, the volume of the collected fluid can be determined by measuring the distance where the GCF has migrated



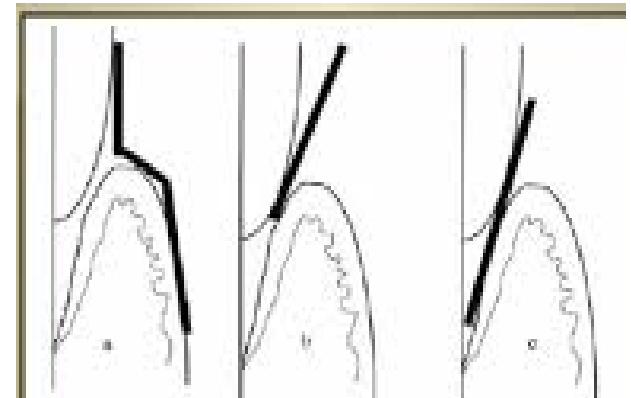
## 3- The use of absorbing paper strip

There are two methods by which the paper strip can be used:

**a. Intra-crevicular method:** the paper strip is inserted gently within the gingival crevice or until minimal resistance is felt



**b. Extra-crevicular method:** the paper strip is adapted on the gingiva and the hard tissue of the tooth in this region so the paper strip will absorb the seepage of GCF



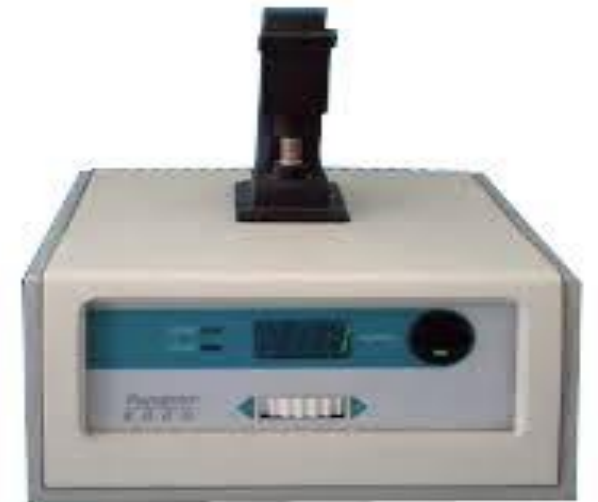
- The amount of GCF collected on a paper strip can be evaluated by a variety of methods:

**a. Staining:** the wetted area of the strip can be made more visible by staining the strip with alcoholic solution of ninhydrin at concentration varying between 0.2 and 2%. Ninhydrin is specific for amino acids and gives a blue or purple colour. The stained region can be measured with an ordinary transparent ruler or vernier

**b. Weighing the strip:** pre-weighted strip is inserted into the gingival crevice and then determined the amount of fluid collected by weighing the sample

**c. Using of periotron:** it is an electronic machine which functioning units are a pair of upper and lower counterparts which can be opened and closed in order to insert or remove the strip of filter paper

- The wetness of the paper strip affects the flow of an electronic current and gives a digital readout



## Composition of GCF

More than 40 compounds found in the GCF have been analysed but their origin is not known with certainty

- These compounds can be host derived or produced by the bacteria in the gingival crevice
- Many efforts have attempted to use GCF components to detect or diagnose active disease or to predict patients at risk for periodontal disease

GCF is composed from the following compounds:

### **1- Cellular elements**

- a. Bacteria
- b. Desquamated epithelial cells
- c. Leukocytes (PMNLs, Lymphocytes and macrophages)

### **2- Electrolytes**

- a. Potassium
- b. Sodium
- c. Calcium

### **3- Organic compound:**

- a. Carbohydrates
- b. Protein
- c. Lipid

#### 4- Metabolic and bacterial products

a. Lactic acid b. Urea c. Endotoxins d. Hydroxyproline

#### 5- Enzyme and other compounds reported in GCF

a. Acid phosphatase b. Alkaline phosphatase c. Prostaglandin E2 d. Collagenase e. Lysozyme f. Cytokines as IL-1B, IL-6 and IL-8 g. Immunoglobulins as IgG, IgM, IgA

#### Clinical significance

The amount of GCF is greater when inflammation is present and it may be proportional to the severity of the inflammation

- GCF increases in the following situations:

1. **Circadian periodicity:** there is a gradual increase in GCF amount from 6 am to 10 pm and then decrease afterward
2. **Sex hormones:** female sex hormones increase GCF flow, probably because they enhance vascular permeability.
  - Pregnancy, ovulation and hormonal contraceptive, all increase gingival fluid production

3. **Mechanical stimulation:** chewing and vigorous gingival brushing stimulate the flow of GCF
4. **Smoking:** produces an immediate transient but marked increase in GCF
5. **Periodontal therapy:** there is an increase in GCF production during the healing period after periodontal surgery

GCF composition in relation to **systemic diseases:**

- Increase in glucose in diabetic patient
- Increase in urea, alteration of protein in kidney disease
- Increase in lactic acid in liver disease
- Increase in calcium in hyperparathyroidism
- Increase in alkaline phosphatase in bone disease (Rickets, Paget's disease)

### Medications in GCF

Medications that are excreted through the GCF may be used advantageously in periodontal therapy

- **Tetracycline** is one of these medications and is effective in treating periodontitis (refractory cases) because of their concentration in the gingival crevice is 2-10 times compared to serum
- This can allow a high drug concentration to be delivered into periodontal pockets and inhibit the growth of *Aggregatibacter actinomycetemcomitans*
- **Metronidazole** is another antibiotic that has been detected in human GCF
- **Ampicillin, cephalexin, rifampicin** were detected too