



## Clinical Study of the Effect of Nano Hydroxyapatite and Conventional Hydroxyapatite Grafts on Socket Healing After Teeth Extraction

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### Abstract

**Background:** Nanomaterials have proven to be highly effective when used in various medical fields. Therefore, they have received great attention from researchers and have been studied in great depth. The use of nanomaterials included grafting bone defects in the maxillofacial region resulting from various causes, including grafting the alveolar socket of extracted teeth to preserve the alveolar process from normal physiological resorption.

**Materials and Methods:** Nano hydroxyapatite paste was applied in the alveoli of extracted teeth immediately after extraction and covered with a barrier membrane of platelet rich fibrin (PRF) and compared with traditional hydroxyapatite bone graft powder and covered with a barrier membrane of platelet rich fibrin (PRF).

**Conclusions:** Within the limits of our study, we conclude that the use of hydroxyapatite powder and nano hydroxyapatite paste, covered with a PRF membrane, has contributed to preventing alveolitis and aids in the healing of soft tissues after extraction.

**Keywords:** Nanohydroxyapatite; Socket Preservation; Platelet-Rich Fibrin (PRF); Alveolitis; Soft Tissue Healing

### Introduction

There is no doubt that hydroxyapatite has played an important role in the restoration of bone defects, as it is one of the most widespread forms of calcium phosphate, and in addition it is involved in the structure of teeth and bones. We cannot fail to note that it directs bone growth, thus accelerating the healing of bone defects, and that it can be manufactured in several physical shapes, different particle sizes, and molds [1,2]. Naturally, the entry of the concept of nanotechnology into the field of biomaterials led to ideal results when used in regenerative treatments based on the principles of tissue engineering, because it improved the physical and biological properties of the materials manufactured in this way,

so it became possible to produce particles of hydroxyapatite of nano sized sizes [2,3]. It is worth noting that the use of platelet-rich fibrin (PRF) in dentistry has spread widely, especially after tooth extraction, because it is a matrix of natural fibers. It has been widely used in the field of guided tissue and bone regeneration (GTR/GBR), either alone as a substitute for bone grafts or as a barrier membrane with different types of bone grafts [4,5].

### Materials and Methods

#### Sample description

The sample size was 40 symmetrical mandibular alveoli for teeth indicated for extraction. The sample was randomly divided into two groups:

- Group (NHA): Nano hydroxyapatite paste was applied with a platelet-rich fibrin (PRF) membrane.
- Group (HA): Conventional hydroxyapatite powder was applied with a platelet-rich fibrin (PRF) membrane.

Patients were followed for a week clinically on days 3, 5, and 7 after alveolar grafting in both groups to evaluate the occurrence of alveolitis.

The patients were followed for a week clinically on the third and seventh days after alveolar grafting and the healing of the soft gingival tissue overlying the socket was followed for both groups.

### Study design

A comparative clinical and study.

### Hydroxyapatite bone grafts

In our study, we relied on two types of hydroxyapatite grafts manufactured by the Portuguese company Fluidinova. The first is hydroxyapatite with Nano-sized particles that have a paste consistency, and it has a concentration of  $15 \pm 1\%$  and a particle size of less than 50 nanometers, while the second is the conventional hydroxyapatite bone graft with micro-sized particles, approximately  $(10.0 \pm 2.0) \mu\text{m}$  and in powder form.

### Surgical steps

- The patient’s consent was taken to undergo surgical procedures and scientific research, and the patient’s medical history was obtained.
- An intraoral clinical and panoramic radiological examination of the patient was performed.
- A blood sample of 40 ml was drawn from the patient and centrifugation was performed at a speed of 3000 rpm for 10 minutes to obtain platelet-rich fibrin (PRF), and it is prepared in the form of a barrier membrane to be applied over bone grafts.
- Teeth indicating extraction were extracted and bone grafts were applied bilaterally.

- Suturing was performed at the extraction site to approximate the free gingival margins and aid healing, and to hold the PRF membrane in place using 3/0 silk suture.
- The patient was given instructions to follow after the extrac-



**Figure 1:** A clinical picture showing a clinical condition after treatment and clinical follow-up. It is clear from the picture that the tissues have completely healed after the extraction and the absence of alveolitis.

tion procedure, and the surgical sutures were removed after a week, a clinical image showing the clinical condition after treatment and clinical follow-up (Figure 1).

### Results

The data we obtained was processed using SPSS Statistics 20, groups with a normal distribution were identified, and a one-way repeated measures ANOVA test was adopted.

Patients were followed for a week clinically on days 3, 5, and 7 after alveolar grafting in both groups, and no post-extraction and grafting alveolitis occurred in both groups (Table 1).

	Alveolitis		Number of Samples
	Yes	No	
NHA	0	20	20
HA	0	20	20
Total	0	40	40

**Table 1:** Study of alveolitis.

The patients were followed for a week clinically on the third and seventh days after alveolar grafting and the healing of the soft gingival tissue overlying the socket was followed for both groups. Complete healing was obtained after extraction and alveolar grafting in both groups (Table 2).

	Soft tissue healing		Number of samples
	Yes	No	
NHA	20	0	20
HA	20	0	20
Total	40	0	40

**Table 2:** Study of soft tissue healing.

### Discussion

Regarding the incidence of alveolitis, the results of the statistical study showed that all study samples did not develop alveolitis during their observation for a week after the extraction procedure, bone grafting, and covering with PRF membrane, it also showed perfect healing of soft tissues without the occurrence of a pathological inflammatory condition.

The results of our study were consistent with many international studies, including:

- We agreed with researcher Debes and his colleagues in their study on preserving the socket after extraction, which was based on the use of calcium sulfate graft. Compared to the natural healing of the socket, the study concluded that the rate of occurrence of socket inflammation in the study group was 0%, compared to the rate of occurrence of socket inflammation following extraction at a rate of 41.7% in the control group. The result of the study was that the use of calcium sulfate grafts led to preventing the occurrence of alveolitis in a serious manner following extraction [6].
- We agreed with the researcher Nisar and his colleagues in their study on preserving the socket using a collagen plug with platelet-rich plasma in the study group, and leaving it to heal spontaneously in the control group. The study concluded that there was no statistically significant difference between both groups [7].

### Conclusion

Through our study, we found that using nano hydroxyapatite paste and hydroxyapatite powder and covering them with PRF membrane did not cause any cases of alveolitis and the healing of the soft tissues was optimal.

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### Conflict of Interest

We note that we did not receive any financial funding from any party.

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