

# Comparative Evaluation of Bleeding and Pain After Orthodontic Extraction with Hemocoagulase V/S 1% Feracrylum Solution – A Prospective Split Mouth Study

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## Abstract

**Background:** A comparative split mouth study of topical feracrylum citrate versus hemocoagulase to minimize post operative bleeding, amount of blood lost and post extraction pain patients. **Patients and Methods:** A total of 30 patients undergoing bilateral orthodontic extraction of first or second premolar were selected for the study. (30 patients, 60 sites, Right-Hemocoagulase Left-Feracrylum). In the study group I Hemocoagulase was used on the right side, 1% feracrylum citrate solution was used on the left side. **Results:** Among the study group I, average post extraction bleeding time was 94.8 mins, amount of blood lost was 4.8mg, post operative pain on day 1 was 3.4, on day 2 was 1.4. In group II, average post extraction bleeding time was 42.8 mins, amount of blood lost was 3.2 mg, post operative pain on day 1 was 0.9, on day 2 was 0.7. None of the patients had any pain on the 7th day. **Conclusions:** Feracrylum is more efficient and safer topical haemostatic agent than Hemocoagulase. It reduced the post operative bleeding, amount of blood lost and post extraction pain.

**Keywords** - Feracrylum, Hemocoagulase, Extraction, Bleeding, Hemostasis

## **INTRODUCTION**

Bleeding is a troublesome, outcome encountered during or after surgical procedure and can cause distress, agony, and discomfort to the patient and the surgeon.

Prolonged bleeding after dental extractions is a complication commonly encountered by oral and maxillofacial surgeons. Postoperative bleeding from an extraction wound may be expected to last for a period of five to fifteen minutes. Hemorrhage exceeding this time will generally require special attention.

Capillary bleeding can occur during minor surgical procedures. Capillary bleeding implies breakdown in supply chain of nutrients and oxygen in the area, leading to impaired wound healing. Restoring the capillary flow ensures faster wound healing and hence, reduced inflammation and infection.<sup>i</sup> Hence blood coagulation, inflammation and tissue repair are closely linked.<sup>ii</sup> Early control of capillary bleeding leads to reduced morbidity of the patient as it enhances healing which leads to faster recovery.

This study was undertaken taking in consideration this phenomenon to study the efficacy of local application of hemocoagulase solution as compared to Feracrylum in post extraction bleeding and pain following orthodontic dental extraction of premolars and to clinically evaluate their usefulness in the practice of oral and maxillofacial surgery.

## **METHODS**

The present study was conducted on 30 patients who reported to the OPD for orthodontic extraction of maxillary or mandibular premolars. All the patients included in the study fulfilled the eligibility criterias. Patients between the age of 17-25 years were selected for the study. To prevent compromise with the bleeding and coagulation time any patient with known inherited or acquired coagulopathy were excluded from the study. Any patient with history of tobacco use were also excluded from the study because of the same

reason. A split mouth design was used to eliminate the bias that could arise by comparing bleeding time of two different individuals. Medically, psychiatrically and physically compromised patients as well as pregnant subjects were excluded. The Institute's ethics committee approved the study, and a written informed consent was obtained from each patient. Patient who did not give consent for the study were also excluded. 30 patients for a total of 60 bilateral orthodontic extractions were selected for the study. Each patient was divided into two groups (Group A and Group B) according to left and right side. Hemocoagulase was used on the right side (Group A) of every patient and Feracrylum was used on the left side (Group B). Patient was assessed post-operatively at the intervals of 1<sup>st</sup> day, 3<sup>rd</sup> day, and 7<sup>th</sup> day. Criteria assessed were bleeding stoppage time, Amount of blood lost, Post-operative pain by visual analogue scale.

## **PROCEDURE**

- Extraction was carried out in a normal way under local anesthesia.
- As soon as the tooth was extracted pre-weighed gauze ball impregnated with 1ml hemocoagulase (botropase) was placed inside the socket and bleeding stoppage time was noted. The socket was analyzed visually every 20 seconds until no bleeding is seen and the time at which complete hemostasis is achieved was noted, same procedure is repeated with a gauze ball impregnated with 1 ml of feracrylum and bleeding stoppage time was noted.
- After the hemostasis was achieved the gauze balls were removed and weighed on the weighing machine.
- The weight of the gauze ball was subtracted from the total weight of the gauze to yield the amount of blood that was lost and was noted.
- Post extraction pain was evaluated using the visual analogue scale on the 1<sup>st</sup>, 3<sup>rd</sup> and 7<sup>th</sup> day.



**Fig 1:** Gauze piece being impregnated with 1ml of hemocoagulase

**Fig 2:** Hemostasis with hemocoagulase



**Fig 4:** Gauze piece being impregnated with 1ml of feracrylum

**Fig 5:** Hemostasis with feracrylum



**Fig 6:** Post operative picture showing hemostasis with hemocoagulase (right) and feracrylum (left)

**Note:** (Green Arrow showing) the formation of a gel like barrier with feracrylum on the left side

## RESULTS

### Statistical Analysis

Data were entered in Microsoft Excel, and statistical analysis was performed using SPSS version 18.0 (Chicago Inc.). Categorical values were expressed in the form of frequencies and percentages, whereas continuous variables were expressed as Mean  $\pm$  SD. Association between different study groups at different time interval was assessed using independent student t test and chi square test. p value was kept at  $< 0.05$  to establish statistical significance.

### Results

7 (23.33%) males and 23 (76.67%) females with a mean age of  $20.3 \pm 2.5$  years (Ref. Range: 17-25) were included in the study (Table 1). Patients with any systemic conditions or history of smoking and alcohol use were excluded from the study. All the patients were referred from the department of Orthodontics for extraction. 30 patients were included in the study. Gauze impregnated with 1ml hemocoagulase was placed on the right side and gauze impregnated with feracrylum was placed on the left side of every patient.

GENDER DISTRIBUTION	No	%
Female	23	23
Male	7	7
	<b>30</b>	<b>30</b>

**Table 1** Showing gender distribution

### Bleeding Stoppage Time

In this study, bleeding stoppage time in group I was  $94.8 \pm 19.7$  min and in group II  $42.8 \pm 7.4$  min ( $P \leq 0.00001$ ). The results showed a lesser bleeding stoppage time when Feracrylum was used for hemostasis. (Table 2)

### Amount of Blood Lost

The intra-operative blood loss in group I was  $4.8 \pm 1.3$  mg and in group II  $3.2 \pm 0.9$  mg ( $P \leq 0.0002$ ). The results showed less blood loss in group II (Table 2)

### Post Extraction Pain

Assessment of severity of pain was done by using Visual Analogue Scale. It was an objective scoring given by patients and categorized into mild (0–4),

moderate (5–8) and severe pain (9–10) (Table 2). All the patients complained of mild pain (0-4), except 1 patient in group I who gave a score of 5.

Comparison of post extraction pain (vas) between the two groups shows that the post extraction pain on day 1 is less with feracrylum,  $2.5 \pm 0.9$  than hemocoagulase,  $3.4 \pm 0.8$  with p value of 0.0001 which is statistically significant.

Comparison of post extraction pain (vas) between the two groups shows that the post operative pain on day 3 with feracrylum was  $0.9 \pm 0.7$  and hemocoagulase was  $1.4 \pm 0.8$  which shows no statistical significance with p value of 0.0345.

On post operative day 7 all the patients in both the groups did not complain of any pain.

	Hemocoagulase		Feracrylum		P Value
	Mean	SD	Mean	SD	
Age	20.3	2.5	20.3	2.5	No Change
Bleeding stoppage time (min)	94.8	19.7	42.8	7.4	0.0000
Amount of blood lost (mg)	4.8	1.3	3.2	0.9	0.0000
Post extraction pain (VAS)					
1 <sup>st</sup> Day	3.4	0.8	2.5	0.9	0.0001
3 <sup>rd</sup> Day	1.4	0.8	0.9	0.7	0.0345
7 <sup>th</sup> Day	0	0.0	0.0	0.0	No Change

**Table 2** - Independent Student t test comparison of the bleeding stoppage time, amount of blood lost, and post extraction pain.

## DISCUSSION

Tooth removal, or extraction, is one of the routinely carried invasive oral surgical procedures in dental practice, Post-extraction bleeding (PEB) is one of the complications of dental extraction that might make a patient panic and seek immediate consultation. As the number of patients on anticoagulant therapy like aspirin, warfarin, and clopidogrel, are rising due to increase in cardiovascular disorders the chance of

encountering PEB is also increasing. Post-extraction bleeding can also result from local or systemic causes that are not expected in routine dental extractions. Other factors that make an individual susceptible includes, negligence in following post extraction instructions. In the past, various local hemostatic measures have been employed to combat problems with hemostasis. Pressure packing, suturing the socket, adrenaline pack or acrylic splint of various constructions have

been used. However, at times bleeding is largely from capillaries which cannot be controlled by mechanical means, wherein drugs would be of a greater value. Biological agents like thrombin, fibrin glue are technically difficult to apply, especially in wet regions such as bleeding extraction sites. They are also expensive and may carry the risk of viral transmission. In some cases, simple compression at the site of bleeding will suffice in obtaining hemostasis, whereas in other times call for more time-consuming procedures. Various local hemostatic agents have been proposed to be applied locally, on extraction sites, which includes hemocoagulase, tranexamic acid mouthwash, fibrin glue, cyanoacrylate, thrombin, microfibrillar collagen, oxidized Cellulose and Feracrylum.

The snake venoms that have shown to induce defibrinogenation include: Ancrod from the venom of *Calloselasma rhodostoma* (formerly known as *Agkistrodon rhodostoma*), batroxobin from the venom of *Bothrops atrox* and *B. moojeni*, and crotalase from the venom of *Crotalus adamanteus*. The purified fractions of ancrod, batroxobin, and crotalase possess coagulant, proteolytic and esterolytic properties, although their primary mechanism of action is a proteolytic effect on circulating fibrinogen. Ancrod cleaves only the A-fibrinopeptides, but not the B-fibrinopeptides, from fibrinogen; this contrasts with thrombin, batroxobin, and crotalase, which cleave both fibrinopeptides A and B.<sup>iii</sup> The hemocoagulase topical solutions are compounds that are applied locally to control surface bleeding and capillary oozing.

The hemocoagulase topical solution is an enzyme complex based fundamentally on coagulative and antihemorrhagic properties of those fractions isolated from the poison of '*Bothrops jararaca* or *Bothrops atrox* Botropase is a hemocoagulase preparation used to arrest bleeding of different etiology. It is an enzyme preparation with hemocoagulase activity which is attributable to the protein batroxobin. The enzyme clots pure fibrinogen like thrombin, releasing fibrinopeptide A from fibrinogen. The enzyme possesses all the typical characteristics of serine proteases and has a molecular weight of 27,000 Da and its isoelectric

point is around 7.5. Botropase is said to have actions like thrombin.<sup>iv</sup> However, there are many differences between the two agents. Botropase is both systemic and local hemocoagulant unlike thrombin. Botropase induced clot is not structurally similar to thrombin clot. Botropase is not absorbed by clot like thrombin. It appears that even in the absence of calcium, botropase can cleave the fibrinogen into fibrin. Antithrombin III does not interfere with botropase hemocoagulant action.

The fibrin clot formed is highly resistant to plasmin and encourages the growth of collagen fibers beneath it. Thus, it reduces the bleeding time,<sup>v</sup> enhances cell division and capillary network formation in wound space and hastens wound healing concomitantly arresting capillary bleeding. Being a topical form it also acts fast and is atoxic.

Hemocoagulase also holds good prospect in managing post-extraction bleeding in cardiac patients on aspirin without stopping aspirin before extraction. Its topical use provides faster hemostasis in patients undergoing dental extraction without any systemic or local adverse effects.

1% Feracrylum citrate, a novel hemostatic agent, It is an effective, safe, reliable topical agent which is used in various surgeries for control of diffuse oozing from the surgical site. It is a water-soluble mixture of incomplete ferrous salt II and III of polyacrylic acid containing 0.05–0.5% of iron. It is biodegradable and hygroscopic. The molecular weight is about 5,00,000–8,00,000 Daltons, due to which there is no systemic absorption. No noted side effects on major organs like liver, kidney, adrenal gland, cardiovascular system and hemopoietic system. It is a chemical haemostatic agent with no local side-effects, less cost, and good haemostatic property. Its use has been documented in many surgical fields.

The effectiveness of feracrylum in reducing the post operative bleeding has been studied in only one study done by **Sachin Rai** *et al* in which they compared the efficacy of Feracrylum as Topical Hemostatic Agent against Tranexamic acid in Therapeutically Anticoagulated Patients Undergoing Dental Extraction. However, it has never been compared with hemocoagulase. This is the first study to compare the haemostatic effect of feracrylum after dental extraction with an

established agent i.e., hemocoagulase. The present prospective study was aimed to assess and compare the effects of hemocoagulase and feracrylum in reducing the post operative bleeding, amount of blood lost and post extraction pain.

In this study the post extraction bleeding was less in both the groups when compared with average bleeding time of 5-15 mins given in literature (Wagner). The mean post operative bleeding in hemocoagulase group was 94.8 secs whereas in the feracrylum group was 42.8 secs. The mean amount of blood lost in hemocoagulase group was 4.8mg and in feracrylum group was 3.2 mg. The difference in pain in both the groups. It is thought that the superior results with feracrylum can be attributed to its property of formation of a mechanical barrier by combining with blood proteins like albumin and form a gel like substance which acts as a barrier on the raw surface which halts the capillary ooze and bleeding and prevents dislodgement of the fragile clot. <sup>vi</sup>

## CONCLUSION

The present study, results may conclude that both hemocoagulase and feracrylum can lesser the post extraction bleeding time, amount of blood lost and pain when compared to the regular dressing of a sterile gauze. There was lesser bleeding stoppage time and also lesser blood loss when Feracrylum was used. Patients recovered from pain and started normal food intake within 2–3 days in both the groups. In this study, majority of the patients experienced lesser pain on the first day in Group II when Feracrylum was used during hemostasis. Feracrylum and hemocoagulase application as a hemostatic agent after extraction is effective in reducing post operative blood loss although the results of using feracrylum are superior. Post op recovery was quick with no side effects or complications. Further studies are recommended with large sample size to confirm these findings.

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