



The effect of gelatin sponge with platelet-rich plasma on pain and soft tissue healing after extraction

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Abstract

Purpose: The aim of this study was to evaluate the influence of gelatin sponge soaked in platelet-rich plasma (PRP) on acceleration and enhancement soft tissue healing and on pain reduction after teeth extraction.

Methods: The sample consisted of 30 patients, each one had 3 teeth indicated to extraction, after teeth removing gelatin sponge with (PRP) was applied in the socket of the first tooth (first study group), gelatin sponge was applied alone in the socket of the second tooth (second study group), the third socket was left to heal spontaneously (control group).

The pain was measured (24,48,72) hour after extraction using Visual Analog Scale (VAS), and the soft tissue healing was assessed by Landry's Wound Healing Index after (3,7) days from the extraction.

Results: The outcomes showed no statistically significant differences between the three groups about the pain reduction, but the results confirmed improvement soft tissue healing in 1st group comparing to 2nd group and control group. The significance was ($P=0.000<0.05$) demonstrated statistically significant difference between the three groups.

Conclusion: The results cleared the benefits of applying gelatin sponge with PRP on acceleration and enhancement the soft tissue healing after extraction, although it had no effect on pain reduction.

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Introduction

Many researches were concerned in studying the idea of teeth extraction and physiological changes of soft tissues and hard tissues and the accompanying complications, many studies investigated in the methods of improve the healing process and alleviating complications after extraction [1-3].

Teeth extraction

It is the elimination of teeth from alveolar bone. It has two kinds: simple extraction and surgical extraction. Recovery such cases is considered a special case of healing in second intention.



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Using platelet-rich plasma (PRP)

The last two decades witnessed many researches about using platelet-rich plasma in the field of medicine and dentistry. These platelets are a store for growth factors released in the wound location or osseous defect to make to support the healing of bone and soft tissues. That is why it called plasma rich in growth factors [4].

There are more than /30/ factors of growth known up till now: Cement growth Factor CGF, Epidermal growth factor EGF, fibroblastic growth factor FGF, insulin growth factor IGF, Transforming growth factor beta TGF-B, platelet-derived growth factor PDGF.

The studies showed that surgery locations using platelet-rich plasma get better /2-3/ folds than normal surgery locations [4,5].

Using gelatin sponge

Gelatin sponge is a local hemostatic used to accelerate and fix the formation of the clot at wounds and bleeding areas. Due to its porosity, flexibility, biocompatibility, it can be used as scaffold or bearing of pharmaceutical compounds that can be applied within the wounds that have osseous defects that enhance the renewal of the bone and makes the wound recover faster [6].

The importance of the research is finding a way to accelerate, improve the healing of soft tissues wounds after the extraction of teeth. The purpose of this research is to evaluate the efficiency of gelatin sponge individually or soaked with platelet-rich plasma to fasten the process healing of gingiva and alleviating pain after normal extraction.

Materials and methods

The sample consists of /30/ patients who consult the department of oral maxillofacial surgery at Faculty of Dentistry, Hama University during the period from 3/2017-11/2017. Each patient has /3/ teeth require extraction.

Input standards

- Age: 18 years & more
- General health: good
- Full cooperation and obligation during censorship period.
- Free from general systematic diseases as diabetes or hemophilia
- Not to involve smokers of more than 5 cigarettes a day.
- Local diseases that hinder healing such as Periodontitis
- No pregnancy due to danger of vasoconstrictor and x-rays.
- No active infection or sepsis.

Study Design: A controlled and random study. All patients were subject to a clinical test and a radiographic test. Extraction took place under local anesthesia. The patient himself was a witness sample and study sample. The sample was divided into three groups:

- Group One: They undergo to gelatin sponge soaked with platelet-rich plasma after extracting the teeth.
- Group Two: They undergo to gelatin after extracting the

teeth.

- Group Three: The teeth were extracted without using any material (control sample).

The patient was not told about the advantages and disadvantages of each method to keep vagueness.

Materials of Research: The ordinary instruments of extraction were used: mirror, probe, forceps, syringe, elevators, needles' holder, scissors, anesthesia ampoules, silk threads 0-3. (Figure 1).



Figure 1: Instruments of extraction

Pulling and concenterfuging blood tools were used: sedimentator, glass tubes, sodium Citrate, micropipette, a syringe to pull blood, (Figure 2), in addition hemostatic gelatin sponge.



Figure 2: Concenterfuging blood tools

Work Stages: After preparing the patient and local anesthesia by using Lidocaine2% with Adrenaline 1/80000, venous blood was taken from the patient and put in a special pipe containing 100 micro liter of Sodium Citrate %10 to prevent clotting. The pipe was put in sedimentator to sediment at the speed 1200 rpm for /7/ minutes, so blood is separated into three layers (top layer platelet-poor plasma, The middle layer: platelet-rich plasma, lower layer (RBC). The layer, platelet-rich plasma was withdrawn and gelatin sponge was soaked with it.

The ligaments of the three teeth to be extracted were cut unharmpfully, extraction was carried out, in the place of the first

tooth gelatin sponge soaked with platelet-rich plasma, in place of the second tooth only sponge is applied, while the socket of the third tooth is left to heal spontaneously.

The two sides of the extraction wound in the three teeth were stitched on the condition stitches are to be removed after 3 days, a piece of gauze was put for biting on it. The patient was given the necessary medical instructions including amoxicillin as an antibiotic, and Paracetamol as a sedative, the patients underwent monitoring and the changes were recorded.

Recording Changes: the pain was measured by using visual analogue scale (VAS) degraded from /0/ (no pain) to /10/ (excessive pain) as in figure (3) in the period (24,48,72 hours).

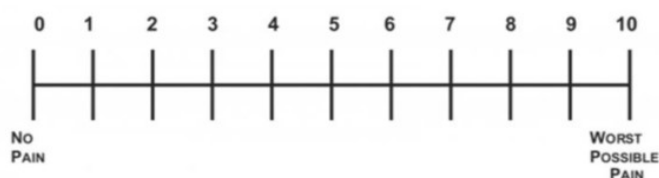


Figure 3: Visual Analogue scale of pain

The healing of soft tissues' wound after extraction in the third and seventh days after extraction was evaluated by using Landry Wound Healing Index scaled five grades: 1 very weak healing, 2 fair, 3 good, 4, very good, 5 excellent (8), (Figure 4).

Healing index	Criteria
Very poor 1	Tissue colour: more than 50% of gingivae red Response to palpation: bleeding Granulation tissue: present Incision margin: not epithelialised, with loss of epithelium beyond margins Suppuration: present
Poor 2	Tissue colour: more than 50% of gingivae red Response to palpation: bleeding Granulation tissue: present Incision margin: not epithelialised, with connective tissue exposed
Good 3	Tissue colour: less than 50% of gingivae red Response to palpation: no bleeding Granulation tissue: none Incision margin: no connective tissue exposed
Very good 4	Tissue colour: less than 25% of gingivae red Response to palpation: no bleeding Granulation tissue: none Incision margin: no connective tissue exposed
Excellent 5	Tissue colour: all gingivae pink Response to palpation: no bleeding Granulation tissue: none Incision margin: no connective tissue exposed

Figure 4: Landry Wound Healing Index

Statistical Study: Statistical analyses were performed using SPSS Version 22 (IBM SPSS Statistics for Windows, NY, USA).

Results

The sample distribution according to gender and age: it is noted in the table (1) that the sample included 30 patients (18 males%60, 12 female %40), their ages were from 24-61 years old with an average age 45, 13 persons were younger from 45 (6 female %20, 7 males %23). It also included 17 persons whose ages are older than 45 years old (6 female %20, 11 male % 37).

distribution according to age	Male	Female	Sum
>45	7 (%23)	6 (%20)	13 (%43)
45>	11 (%37)	6 (%20)	17 (%57)
Sum	18 (%60)	12 (%40)	30 (%100)

Table 1: Sample distribution according to age and sex

The sample included 90 teeth (48 teeth in the maxillary %53 and 42 teeth in the mandibular %47). The study involved 27 inferior teeth %30, 32 to premolars (%35.5), 31 molars (%34.5), table (2).

Distribution according the tooth	Mandible	Maxilla	Sum
Anterior	13 (%14.5)	14 (%15.5)	27 (%30)
Premolar	14 (%15.5)	18 (%20)	32 (%35.5)
Posterior	15 (%17)	16 (%17.5)	31 (%34.5)
Sum	42 (%47)	48 (%53)	90 (%100)

Table 2: Sample distribution according the tooth location

Results of applying sponge soaked with platelet-rich plasma on pain after extraction: It is noted in the table 3 that there is no important statistical difference among the three groups according to analysis One Way ANOVA in all follow-up periods 24, 48, 72 hours where the P value reached P 0.937, 0.995, 0.995 consequently and it is bigger than the significant level 0.05.

		Sum of Squares	df	Mean Square	F	P-value
Pain after 24h	Between Groups	.267	2	.133	.065	.937
	Within Groups	177.833	87	2.044		
Pain after 48h	Between Groups	0.22	2	.011	.005	.995
	Within Groups	192.433	87	2.212		
Pain after 72h	Between Groups	0.22	2	.011	.005	.995
	Within Groups	192.433	87	2.212		

Table 3: One-Way ANOVA analysis of pain

On considering the means of pain amount in the three groups, it is noted that there is no change in the measurement of pain during all follow-up periods among the three groups, this refers that sponge soaked with platelet-rich plasma has no effect on pain after extraction, table(4).

	Application	Count	Range	Mean±SD
Pain after 24h	Sponge+PRP	30	2-6	3.97±1.19
	Sponge	30	2-10	3.90±1.56
	nothing	30	2-9	3.83±1.51
Pain after 48h	Sponge+PRP	30	2-6	3.53±1.22
	Sponge	30	1-10	3.53±1.68
	Nothing	30	1-8	3.50±1.53
Pain after 72h	Sponge+PRP	30	1-5	2.67±1.30
	Sponge	30	1-8	2.67±1.56
	Nothing	30	1-7	2.63±1.59

Table 4: Statistical results of pain

Results of application of sponge soaked with platelet-rich plasma on healing of soft tissues and wound of extraction: The test One Way ANOVA was applied to compare among the averages registered after 3-7 days to Landry's Wound Healing Index in the three groups. It is clear in the table (5) that the value reached P 0.000 in the third and seventh day. This is less than the significant level 0.05. This has ascertained that there are differences of statistical index among the three groups.

		Sum of Squares	df	Mean Square		P-value
Healing after 3days	Between Groups	48.689	2	24.344	51.324	.000
	Within Groups	41.267	87	.474		
Healing after 7days	Between Groups	54.600	2	22.800	50.992	.000
	Within Groups	38.900	87	.447		

Table 5: One-Way ANOVA analysis of healing index

On conducting Tukey Test to the differences in groups separately, it is noted that there is a statistical difference among the healing average of sponge soaked with platelet-rich plasma group and only sponge group for the sake of the first group as the value P 0.000 is smaller than 0.05 at the times of measuring. There was also an important statistical difference between sponge soaked with platelet-rich plasma group and the third witness group on the third and seventh days for the sake of the first group so the value P 0.000 smaller than 0.05, while there was no difference between only sponge group and the control group as P 0.152 on the third day and P 0.481 on the seventh day. This is bigger than the significant level 0,05, table (6).

		Mean±SD	P-value
Healing after 3days	1 st and 2 nd groups	1.367±0.18	0.000
	1 st and 3 rd groups	1.700±0.18	0.000
	2 nd and 3 rd groups	0.333±0.18	0.152
Healing after 7days	1 st and 2 nd groups	1.400±0.17	0.000
	1 st and 3 rd groups	1.600±0.17	0.000
	2 nd and 3 rd groups	0.200±0.17	0.481

Table 6: Tukey analysis of healing index

This is what the table (7) emphasizes, as the averages of values of Landry's Wound Healing Index on the third day in the first group 4.00 is bigger than the mean of values in the second group 2.63 which in its turn is simply bigger than the control group 2.30. On the third day the mean of group one 4.83 and the mean of the second group is 3.43 and the third 3.23.

	Application	Count	Range	Mean±SD
Healing on 3 rd day	Sponge+PRP	30	3-5	4.00±0.53
	Sponge	30	1-5	2.63±0.85
	nothing	30	1-4	2.30±0.65
Healing on 7 th day	Sponge+PRP	30	3-5	4.83±0.46
	Sponge	30	2-5	3.43±0.77
	nothing	30	2-5	3.23±0.76

Table 7: Statistical results of healing index

So the sponge soaked with platelet-rich plasma group was useful in improving the process of physiological healing, but applying only gelatin sponge had no effect of healing of the soft tissues wound, (Figures 5,6).



Figure 5: Patient from the sample [upper premolar belong 3rd group, the lower premolar belong 2nd group and the lower first molar belong 1st group]



After Extraction



After 7 Days

Figure 6: Patient from the sample [first premolar belong 1st group, the second premolar belong 2nd group and the first molar belong 3rd group]

Results of complications after extraction: Three cases of alveolar Osteitis were registered (%3.33). One in each group was known through the clinical symptoms, extraction with discharge in the vestibular bone was registered in the sponge soaked with platelet-rich plasma group due to an alveolar-dental adhesion that resulted in an influence on the consequent pain and healing.

No cases of late hemorrhage were registered after extraction and there were no differences among the groups due to the stop of consequent hemorrhage after extraction.

Discussion

Discussing study design

Split mouth design was adopted because this makes the patient himself plays the witness role and by means of this design the effect of personal response can be reduced and isolate the different and individual factor among people.

As the experience of the doctor can affect on the complications after extraction, one surgeon executed all the procedures in this study to deviate that factor.

The sample was distributed into three groups (the basic study group on which sponge soaked with platelet-rich plasma was applied, a secondary study group on which only gelatin sponge was applied to know and isolate the role of sponge as

a hemostatic in healing and the third group as a witness group was left to heal spontaneously). This design agrees with many studies such as Rutkowski [1] and Tavakoli [3].

Discussing the distribution of the sample: Male rate was 60%, which is higher than female, which is 40%, and the average age were 45 years old. This is higher than the average ages in most similar studies. This can be attributed to the rise in the rate of having three teeth were treated by extraction at young age cases than older ages ones. This agrees with the study Rutkowski et al [1].

The samples were equally distributed between the two jaws 53% in the maxillary and 47% in the mandibular. While the distribution according to the tooth location in the jaw was 30% anterior, 35.5% premolars and 34.5% molars.

It is noted that the rate of the anterior teeth extracted was less than the rate of premolars and molars due to the individual's tendency to care about the health of anterior teeth and refuse the idea of extracting them more than the posterior teeth aesthetically.

discussing the study results regarding pain after extraction: pain was measured according to VAS that is considered a serious method in its estimating when the variable to be measured is connected by the personal response of the patient and many studied depended on it because of its effectiveness[1,7,9,10].

This study has shown that the average of pain in all times of measurement was with the first group of study on which sponge soaked with platelet-rich plasma was applied does not differ importantly and statistically from the pain in the witness group and this is different from all studies such as Ogundiye et al [10], Moraschini [11], and Dutta [12] that refer to alleviating pain when applying sponge soaked with platelet-rich plasma after extraction inside the alveolar socket.

Besides, the results of pain varied from the results of study Pal et al [7], which showed that the application of sponge soaked with platelet-rich plasma as a bandage of alveolar inflammation is useful in alleviating pain.

This difference can be attributed to the fact that every patient extracted three teeth at one session and some patients had extracted adjacent teeth, nearby or opposite each other that affected on pain sensation and scattered it in the jaw, therefore inability to determine the place of pain well. However, the distribution of the extracted teeth in the jaws and their location in the one jaw has an effect on the intensity of pain, and the stitches annoy the patient and make him feel uncomfortable.

The results of pain in this study agreed with the study Rutkowski et al [1] that it is no longer the significant index of pain after the application of sponge soaked with platelet-rich plasma in the extraction socket of the third molars, which is attributed to the fact that sedatives after surgery prevented the patient from clear complaint from pain.

As for the study of the secondary group, the results in this research have shown that gelatin sponge alone does not help in alleviating pain, the average pain was slightly bigger than the average pain in witness group that has no statistical difference. This is approximate to the results of Petersen et al [13] that found the application of gelatin sponge alone in the extraction socket was bigger than the pain when using any material.

While the results of the study of Tavakoli et al [3] that recom-

mended to apply hemostatic sponge in extraction socket differ, because it alleviates inflammation in the tissues and the consequent annoyance. This difference can be interpreted that Tavakoli applied sponge inside the extraction socket of the third premolar with a special kind of cats so the intensity of pain could not be measured accurately.

The summit of pain in the three groups reached on the first day at 12-18 hours after extraction.

Discussing the results of study regarding healing of soft issues after extraction: The patient was summoned after 3-7 days of extraction to record the healing values by using Landry Wound Healing Index that evaluates healing of wounds according to tissue color, hemorrhage on touching, formation of epithelial tissue and granular tissue existence [8], many modern studies were based on this index to measure the healing quality and speed of soft tissues [9,12,14].

From the results of this study, it is noted that gelatin sponge soaked with platelet-rich plasma benefited in enhancing the healing of soft tissues that agrees with all studies that investigated in the effectiveness of platelet-rich plasma held on gelatin sponge in healing of soft tissues similar to the study of Pal et al [7] that compared the role of gelatin sponge soaked with platelet-rich plasma with the bandage of zinc oxide-eugenol in managing the alveolar inflammation after extraction. Its results showed the effectiveness of sponge soaked with platelet-rich plasma in improving the quality of healing. This goes back to the properties of growth factors existed in high concentrations in the platelet that could be activated when there are wounds and lead to healing by catalyzing the inflammatory cells and their migration, formation of new blood vessels, Mitosis, differentiation of Fibroblasts and thus enhancement of wound healing. This agrees with many studies that detected the ability of sponge soaked with platelet-rich plasma to improve and strengthen of healing of soft tissues [1,9,12,14].

The results of the research have shown that hemostatic sponge alone have no benefit in improving and accelerating healing importantly and statistically. The credit in healing quality in the first group goes to the existence of PRP, despite of this using only hemostatic sponge does not delay healing. This is a discrepancy with the results of Petersen et al [13] and with the results of Boyes-Varley et al [15] who investigated in the healing of soft tissues with some monkeys after applying gelatin sponge alone or sponge soaked with medicines. The results revealed that putting only gelatin sponge in the extraction socket delays the scar of the wound and slows down healing. This difference can be justified that there is a simple immune reaction that increases the immunity stage at healing stages of the wound and that delays the following stage, which is the stage of epithelial tissue due to saliva and oral carelessness with experiment animals. This also causes to prolonged immune response; besides, stitching carried out on teeth of the sample in this study provided some protection and stability of the formed clot within minutes through the properties of hemostatic gelatin sponge. The more stable the clot is at the extraction socket, the less the inflammation and pain are. This corresponds to with the study of Tavakoli et al [3] that studied using hemostatic gelatin sponge for healing after extraction. Its results have showed that the stability of clotting at the early stages of healing protects them from dissolution, infection and alveolar inflammation. However, there is no significant difference in forming epithelial tissue between the two groups in his study.

Discussing the study results regarding the complications accompanying extraction: The results have shown that there are no significant difference among the three groups of complications' occurrence, the rate of alveolar inflammation in each group was 3.3% which is similar to the results of Rutkowski et al [1]. Besides, there was no delayed hemorrhage or prolonging in the period of hemorrhage and clotting in any case. This can be attributed to patients' commitment to oral care and absence of smoking and systematic diseases in study sample.

From this study, it can be deduced that gelatin sponge soaked with platelet-rich plasma can accelerate and improve healing after extraction but does not affect on pain. So, it is recommended within the limits of this study to be applied in dental clinics for extraction patients when there is a necessity for quick restoration in case of loss.

References

1. Rutkowski JL, Johnson DA, Radio NM, Fennell JW. Platelet rich plasma to facilitate wound healing following tooth extraction. *Journal of Oral Implantology*. 2010; 36: 11-23.]
2. Yoneda T, Tomofuji T, Kawabata Y, Ekuni D, Azuma T, et al. Application of coenzyme Q10 for accelerating soft tissue wound healing after tooth extraction in rats. *Nutrients* 2014; 6: 5756-5769.
3. Tavakoli A, Sagart A. Evaluation of hemosponge in promoting dental socket healing after 3rd mandibular premolar extraction in a feline model. *Brazilian Journal of Oral Sciences*. 2015; 14: 330-333.
4. Whitman DH, Berry RL, Green DM. Platelet gel: An autologous alternative to fibrin glue with applications in oral and maxillofacial surgery. *Journal of Oral and Maxillofacial Surgery*. 1997; 55: 1294-1299.]
5. Marx RE. Platelet-Rich Plasma: A source of multiple autologous growth factors for bone grafts. *Quintessence* 1999; 4: 71-82.
6. Rohanizadeh R, Swain MV, Mason RS. Gelatin sponges (Gel-foam®) as a scaffold for osteoblasts. *Journal of Materials Science: Materials in Medicine*. 2008; 19: 1173-1182.
7. Pal US, Singh BP, Verma V. Comparative evaluation of zinc oxide eugenol versus gelatin sponge soaked in plasma rich in growth factor in the treatment of dry socket: An initial study. *Contemporary clinical dentistry*. 2013; 4: 37.]
8. Landry RG, Turnbull RS, Howley T. Effectiveness of benzydamyne HCl in the treatment of periodontal post-surgical patients. *Research Clinical Forums* 1988; 10: 105-118.
9. Alissa R, Esposito M, Horner K, Oliver R. The influence of platelet-rich plasma on the healing of extraction sockets: an explorative randomised clinical trial. *European journal of oral implantology*. 2010; 3.]
10. Ogundipe OK, Ugboko VI, Owotade FJ. Can autologous platelet-rich plasma gel enhance healing after surgical extraction of mandibular third molars? *Journal of Oral and Maxillofacial Surgery*. 2011; 69: 2305-2310.
11. Moraschini V, Barboza ESP. Effect of autologous platelet concentrates for alveolar socket preservation: a systematic review. *International journal of oral and maxillofacial surgery*. 2015; 44: 632-641.
12. Dutta SR, Singh P, Passi D, Patter P. Mandibular third molar extraction wound healing with and without platelet rich plasma:

-
- A comparative prospective study. *Journal of maxillofacial and oral surgery*. 2015; 14: 808-815.
13. Petersen JK, Krogsgaard J, Nielsen KM, Nørgaard EB. A comparison between two absorbable hemostatic agents: gelatin sponge (Spongostan®) and oxidized regenerated cellulose (Surgicel®). *International journal of oral surgery*. 1984; 13: 406-410.]
 14. Prabhusankar K, Balamurgan L, Usha V, Varun M. Efficacy of Gelatamp in reduction of post operative complication and soft tissue healing after impacted mandibular 3rd molar surgery. *International journal of current research*. 2017; 9: 48096-48101.
 15. Boyes-varley JG, Cleaton-jones PE, Lownie JF. Effect of a topical drug combination on the early healing of extraction sockets in the vervet monkey. *International journal of oral and maxillofacial surgery* 1988; 17: 138-141.
 16. Kang BS, Na YC, Jin YW. Comparison of the wound healing effect of cellulose and gelatin: an in vivo study. *Archives of plastic surgery*. 2012; 39: 317-321.]