



## Socket-Shield Technique for Buccofacial Tissues Preservation with Immediate Implant Placement and PRF Application (Clinical and Radiographic Evaluation)

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### KEYWORDS

Socket-Shield Technique,  
Buccofacial Tissues Preservation,  
Immediate Implant , PRF ,  
Osseointegration.

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### ABSTRACT

**Aim:** The aim of this study was to assess clinically and radiographically the efficacy of the socket shield technique in maintaining facial contours and crestal bone after immediate implant placement, combined with PRF application. **Subject and Methods:** Sixteens patients with 16 implants were divided into two groups, Group “1”: 8 Patients were subjected to socket shield procedure combined with immediate implant placement alone. Group “2”: 8 Patients were subject to socket Shield technique and immediate implant placement combined with PRF application. Clinical parameters were gathered at baseline, 6-, and 12-months post-operative. **Results:** There was a statistically significant difference between (Group 1) and (Group 2) in (mSGI), There was a statistically significant difference between (Group 1) and (Group 2) at 6 months in implant stability, and there was a statistically significant difference between both groups at 6 months in peri-implant pocket depth, there was no statistically significant difference between (Group 1) and (Group 2) in modified plaque index. Also, there was no statistically significant difference between (Group 1) and (Group 2) at different periods in bone density, In addition, There was a statistically significant difference between (Group 1) and (Group 2) groups at 12 months in (MBL). While there was no statistically significant difference between (Baseline), (6m), and (12m) between the two groups in labial bone thickness. **Conclusion:** The socket shield technique with or without PRF application was shown to be effective to achieve osseointegration without any inflammatory response. Using PRF with socket shield and immediate dental implants exhibited to be superior to immediate dental implants with socket shield alone in improving peri-implant conditions and dental implants.

### INTRODUCTION

Gradual loss of the alveolar ridge width and height usually occurs after the healing of extraction sockets <sup>(1)</sup>. Optimal stability and support of the hard and soft tissues surrounding dental implants as well as the three-dimensional positioning of the implant and the orientation of the future restoration may be compromised by this alteration of ridge contour <sup>(2)</sup>.

One of the well-known and successful treatment options for rehabilitation of the extraction socket following tooth removal is immediate implant placement <sup>(3)</sup>. A gingival recession of at least 1 mm is expected at the facial aspect, especially with poor gingival biotypes following immediate implant placement <sup>(4)</sup>.

Successful esthetic outcomes depend on the height and thickness of the facial and interproximal bone, they are considered important factors in the esthetic zone which are usually determined by the presence of an intact interdental papilla as well as the color and surface texture of the marginal peri-implant mucosa and <sup>(5)</sup>.

Markus B. Hürzeler was the first to introduce the socket shield technique in the field of implant dentistry in 2010<sup>(6)</sup>. He stated that leaving the labial aspect of the root is having significant beneficial effects in preserving the buccal plate of the bone instead of extracting the whole tooth, hence decreasing the incidence of post-extraction resorption sequelae and alteration in the ridge contour <sup>(7,8)</sup>. It is considered a promising technique for the preservation of the extraction sockets especially in challenging cases aesthetically <sup>(6)</sup>.

The concept of socket shield is based on maintaining the normal physiologic relationship between the buccal/facial root section of a tooth to be extracted and the facial plate of bone by keeping the periodontal attachment apparatus undamaged, this will, in turn, prevent remodeling the expected post-extraction socket, provide support to the facial tissues, allow the implant to be accurately placed and consequently optimally stable esthetic result after the final delivery of the restoration <sup>(9,10)</sup>.

Based on that, our study aimed to evaluate the efficacy of the socket shield technique clinically and radiographically in maintaining facial contours and marginal bone after immediate implant placement, combined with PRF application.

## PATIENTS AND METHODS

The present study was designed and implemented as a randomized controlled clinical trial carried out on 16 patients of both sexes (8 females and 8 males) with age ranges from 22 – 45 years (mean age of 33.5 years). All patients were enrolled for the socket shield technique with immediate dental implant placement.

Patients were selected and recruited from the outpatient clinics of the Oral Medicine and Periodontology Department, Faculty of Dental Medicine, Al-Azhar University, Assiut Branch.

- **Ethical approval:** This study was approved and granted by the Faculty of Dental Medicine, Al-Azhar University, Assiut Branch Research Ethics Committee. All patients who participated in this research provided written informed consent before the procedure to participate in this study.

- **Inclusion criteria:**

1. Patient is medically free (ASA 1).
2. Patients with upper non-restorable single-rooted tooth requires implant rehabilitation in the esthetic zone as determined by clinical and radiographic examination.
3. Absence of related pathology.
4. Absence of periodontal disease.

- **Sample size calculation:**

The power analysis was done using G\* Power system for a one-way fixed effects analysis of variance (ANOVA). The criterion for significance was set at  $\alpha = 0.05$  (type I error) and  $\beta = 0.20$  (type II error). The sample size is 8 cases per group (16 total) would be required.

- **Study design:**

Sixteens patients with 16 implants were divided randomly into two equal groups, by using a flip of a coin as the following:



**Group 1:** 8 Patients were subjected to immediate implant placement with socket shield procedure alone.

**Group 2:** 8 Patients were subjected to immediate implant placement and socket shield technique combined with PRF application.

- **Surgical procedure:**

The involved tooth was decoronated with surgical bur with a tapered end approximately 1mm apical to the gingival margin. The remaining root structure was sectioned horizontally, the root fragments were removed at the palatal, distal, and mesial aspects and the buccal portion of the root was left in its position. After the palatal part was removed, the socket was thoroughly debrided by careful curettage and irrigated with sterile saline solution to remove any infected or inflammatory tissues.

Implant site preparation was done in the usual sequential drilling manner. The implant was then inserted apically into the preserved root fragment (shield part) according to determine length.

- **Platelet-rich fibrin (PRF) preparation:** <sup>(11)</sup>

For the preparation of PRF, a butterfly needle was used to retrieve ten ml of blood from the patient in a 10ml vacuum tube without the addition of anticoagulants. The collected blood was immediately centrifuged on a table-top centrifuge at a rate of 3000 rpm for 10 minutes. Three layers were obtained in the test tube after centrifugation, The RBCs layer was found at the bottom of the test tube, PRF clot in the middle, and the uppermost layer consists of cellular platelet-poor plasma (PPP). The middle PRF was then grasped with sterile tweezers and discarded from the underlying RBC layer using sharp scissors to be transferred to a specialized PRF box. By compressing PRF clot in special tools like “PRF Box” resulting in standardized PRF membranes of constant thickness and size along with PRF exudate.

- \* **Clinical evaluation**

The periodontal conditions of each patient around peri-implant tissue were evaluated at baseline 6 and 12 months using the following peri-implant parameters: peri-implant probing depth (PPD)<sup>(12)</sup>, Modified Plaque Index (mPI)<sup>(13)</sup>, Modified sulcular Bleeding Index (mSBI)<sup>(13)</sup>, and Implant stability<sup>(14)</sup>.

- \* **Radiographic evaluation**

Cone-beam computed tomography was done pre-operatively, immediately and at 6 & 12 months postoperatively, to assess bone density and marginal bone loss around dental implants and labial bone thickness.

## RESULTS

The changes in the clinical parameters in this study were illustrated in **Table 1:**

There was no statistically significant difference in relation between both groups at a baseline, 6 months, and 12 months post-operative regarding *the modified plaque index* (mPI).

*The modified sulcular Gingival index* (mSGI) showed that there was no statistically significant difference between **(Group 1)** and **(Group 2)** at baseline and 6 months, while there was a statistically significant difference between both groups at 12 months period. In addition, no statistically significant difference was shown between **the tested groups** at a baseline and 12 months while there was a statistically significant difference between both groups at 6 months for *peri-implant probing depth* (PPD).

Measuring Bone Density (BD) demonstrated that no statistically significant difference between **(Group 1)** and **(Group 2)** at all different periods. In addition, assessment of Marginal Bone Level (MBL) revealed that a statistically significant difference between both groups at 12 months.

While at a baseline and 6 months there was no statistically significant difference. Moreover, **Labial bone thickness (LBT)** showed that there was no statistically significant difference between **(Group 1)** and **(Group 2)** at all the different periods.

Regarding **The implant stability**, the results of the present study showed there was no statistically significant difference between **(Group 1)** and **(Group 2)** at a baseline while there was a statistically significant difference at 6 months.

**Table (1)** Showing means  $\pm$  SD scores of Modified Plaque Index (MPI), Modified Gingival Index, Peri-implant Probing Depth (PPD), Bone density (BD) in HU, and Marginal Bone Level (MBL), Labial bone thickness (LBT), Implant stability Quotient I(ISQ) at a baseline of 6 months, and 12 months post-operative in each group (G).

Parameters	Group	Baseline	6m	12m
		Mean $\pm$ SD	Mean $\pm$ SD	Mean $\pm$ SD
MPI	Group 1	0.000	0.082	0.104
	Group 2	0.000	0.038	0.069
mSGI	Group 1	0.000	0.067	0.092
	Group 2	0.000	0.109	0.060
PPD	Group 1	0.000	0.155	0.402
	Group 2	0.000	0.327	0.352
BD	Group 1	109.77	105.28	100.96
	Group 2	150.11	153.62	142.33
MBL	Group 1	0.000	0.990	1.090
	Group 2	0.000	0.810	0.864
LBT	Group 1	1.440	1.400	1.380
	Group 2	1.330	1.320	1.300
ISQ	Group 1	72.000	73.000	
	Group 2	75.000	78.000	

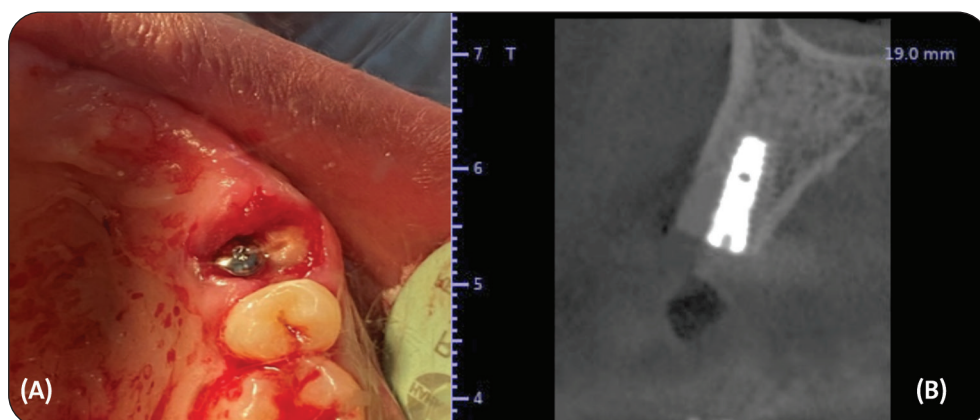


Fig. (1) A) Dental Implant after being inserted using socket shield technique, B) Postoperative Cone beam CT

## DISCUSSION

The presence of healthy bone with sufficient volume at the implant recipient site is one of the most important factors for the success of Osseointegrated dental implants. The insertion of an implant at a site with a thin buccal plate of bone is usually challenging and predominately associated with a significant buccal bone resorption. Thus, it is always necessary to perform all possible efforts and use specialized tools to preserve the buccal alveolar bone during extraction procedures<sup>(14)</sup>.

Bone remodeling at buccal or labial plate of bone is more noticeable than in the palatal plate, which will consequently have negative adverse effects on the outcome of the final restoration<sup>(15)</sup>.

A lot of modalities have been proposed to avoid the negative consequences of tooth extraction, such as immediate dental implants<sup>(16)</sup>, different graft materials<sup>(17)</sup>, and membranes<sup>(18)</sup>.

However, as reported by many studies no single technique of bone preservation has proven to be superior to others. On the other hand, many Clinical trials in the literature have suggested that leaving the facial section of the remaining roots of hopeless teeth in their sockets prevents or decreases the incidence of soft and hard tissue alterations and bone resorption as well after tooth extraction<sup>(19)</sup>.

The aim of the current study was trial to evaluate the efficacy of the socket shield technique in maintaining facial contours and marginal bone after immediate implant placement, with or without PRF.

The current study was designed to replace single-rooted teeth since it was reported that immediate placement of a single implant in molar regions usually faces numerous challenges regarding accurate implant anatomic positioning, occlusal, and biomechanical factors<sup>(20)</sup>. Immediate implant rehabilitation using the Socket Shield technique for hopeless maxillary anterior teeth was selected in our study owing to the complexity of the surgical

procedure, as well as the changes that follow every tooth extraction<sup>(7)</sup>.

Moreover, in our study, the gap that remained between the labial section of the root and implant was filled with PRF, to gain all the benefits of this autogenous material regarding its osteogenesis and osteoconductive healing capabilities, promoting growth factors, such as platelet-derived growth factor and vascular endothelial growth factor for bone regeneration and microvascular formation in the newly regenerated bone, its ability to provide an anti-inflammatory medium during the bone-healing period<sup>(21)</sup>. In addition to its applicability and low expenses<sup>(22)</sup>.

The mean value of the primary stability (ISQ) was 62 ISQ for group 1 and 67 ISQ for group 2. This agrees with **Shiigai in** and **Anitha et al**<sup>(23)</sup>. They mentioned that the primary stability of implant with ISQ more than 60 is suitable. In addition, the secondary stability in the present study increased with time. The mean of the secondary implant stability quotient (ISQ) was 64 ISQ for group I and 73.3 ISQ for group II. These findings are agreed with the study by **Coelho et al**<sup>(24)</sup>. They stated that biological stability (secondary stability) becomes apparent only as new bone forms around the implant, ISQ values increased significantly over time and towards the sixth month.

Regarding the results of implant stability for the tested groups of the present work, a statistically significant difference was showed between them due to the application of PRF in **Group 2** which enhances the oessointegration around the implant.

Additionally, the present study showed a marked reduction in PPD at 6 and 12 months post-surgically. A reduction in peri-implant probing depth from 6 to 12 months post-surgically was 2.088 to 1.88 mm. This reduction in pre-implant probing depth was greater in sites treated with PRF compared to sites treated with socket shield without PRF which showed a reduction in peri-implant probing depth from 2.413 to 2.013 mm.



Moreover, our results demonstrated a statistically significant difference at 6 months when compared to **Group 1**. We can claim that this difference was attributed to the high healing capabilities of the PRF on soft tissues. This agrees with **Chang** <sup>(25)</sup>, reported that PRF releases a different growth factors that promote the peri-implant tissue regeneration.

Its important to note that the labial bone thickness in **Group 2** demonstrated higher values when compared with **Group 1**, but with no statistically significant difference, this indicates that the socket shield technique exhibits superior maintain the bone thickness.

The bone density in **Group 2** showed the highest value followed by **Group 1**, without statistically significant. This contributed to that PRF may lead to the enhancement of new bone, even at 4 months.

In the present study, the Socket Shield technique was modified by inserting implants together with PRF which was proven to be beneficial to the final outcome. PRF was very helpful in promoting bone formation in the gap between the residual root segment and implant and preserving peri-implant tissue and contour; hence, the final prostheses exhibited a proper function and demonstrated no significant gingival recession.

Finally, the success of osseointegration of dental implants depends on whether a sufficient volume of healthy bone are found in the recipient site at the time of implant placement to streamline the process and shorten treatment time, immediate implant protocols has been introduced. Therefore, the socket shield technique was introduced to make a positive difference.

## CONCLUSION

Using PRF with socket shield and immediate dental implants exhibited to be superior to immediate dental implant with socket shield alone regarding marginal bone level and implant stability as well

as peri-implant probing depth. PRF Application promotes bone regeneration in the gap between the residual root segment and implant, suggesting that the application of PRF can be considered as adjunctive promising in improving hard and soft tissue profiles around dental implants in the Socket Shield Technique.

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## تقنية درع حق السنه للحفاظ على أنسجة الوجه الشدقية باستخدام وضع الزرع الفوري والبلازما الغنيه بالالياف (التقييم السريري والشعاعي)

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### الملخص :

**الهدف:** كان الهدف من هذه الدراسة هو التقييم السريري والشعاعي لفعالية تقنية درع حق السنه في الحفاظ على ملامح الوجه وعظم القشرة بعد وضع الزرع الفوري. جنباً إلى جنب مع البلازما الغنيه بالالياف

**المواد والاساليب:** تم تقسيم ستة عشر مريضاً لديهم 16 زراعة إلى مجموعتين. المجموعة «1»: 8 مرضى تعرضوا لإجراء درع التجويف مع وضع الغرسه الفورية وحدها. المجموعة «2»: 8 مرضى خضعوا لتقنية «درع التجويف السنى» ووضع الزرع الفوري مع تطبيق البلازما العنية بالالياف. تم جمع العلامات السريرية عند خط الأساس. بعد 6 و12 شهرًا من العملية الجراحية.

**النتائج:** كان هناك فرق ذو دلالة إحصائية بين المجموعة (1) و (المجموعة 2) في (MSGI). وكان هناك فرق ذو دلالة إحصائية بين المجموعة (1) و (المجموعة 2) عند 6 أشهر في ثبات الزرع. وكان هناك فرق ذو دلالة إحصائية الفرق بين المجموعتين عند 6 أشهر في عمق الجيب المحيط بالزراعة. لم يكن هناك فرق ذو دلالة إحصائية بين المجموعة (1) و (المجموعة 2) في مؤشر البلاك المعدل. كما لم يكن هناك فروق ذات دلالة إحصائية بين المجموعة (1) و (المجموعة 2) بفترات مختلفة في كثافة العظام. بالإضافة إلى ذلك. كان هناك فرق ذو دلالة إحصائية بين المجموعتين (المجموعة 1) و (المجموعة 2) عند 12 شهرا في ( إم بي إل). بينما لم يكن هناك فرق ذو دلالة إحصائية بين (خط الأساس) و(6م) و(12م) بين المجموعتين في سمك عظم الشفة.

**الخلاصه:** أظهرت تقنية درع المقبس مع أو بدون تطبيق البلازما الغنية بالصفائح فعاليتها في تحقيق التكامل العظمي دون أي استجابة التهابية. أظهر استخدام البلازما الغنية بالصفائح مع درع المقبس وزراعة الأسنان الفورية أنه يتفوق على زراعة الأسنان الفورية مع درع المقبس وحده في تحسين الظروف المحيطة بالزرع وزراعة الأسنان.

**الكلمات المفتاحية:** تقنية درع الحق السنى. الحفاظ على أنسجة الشدقيه. الغرسه الفوريه. البلازما الغنية بالالياف. تداخل العظمى.

