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EVALUATION OF AMNION CHORION MEMBRANE FOR SOCKET PRESERVATION AFTER THE EXTRACTION OF MAXILLARY SINGLE ROOTED TEETH: A RANDOMIZED CONTROLLED CLINICAL TRIAL

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Introduction: The aim of this study was to assess the efficiency of using dehydrated de-epithelialized amnion chorion membrane (ddACM) on socket preservation in the anterior region, clinically and radiographically.

Methods: 26 unrestorable maxillary anterior or single rooted premolars, with buccal fenestration, were selected. The socket was filled with allograft material and covered with ddACM for the test group, and allograft material with a collagen membrane for the control group divided equally. Clinical parameters including gingival healing and tissue thickness was assessed. Volumetric bone change was measured 4 months later using a CBCT.

Results: Test group showed clinical statistically significant results than the control group (*P*-value = 0.020, effect size = 0.574) along with a radiographic higher mean bone width measurement than control group after four months (*P*-value = 0.372, Effect size = 0.357).

Conclusion: As compared to collagen membrane, intentionally exposed ACM is similarly successful in ridge preservation. Moreover, the use of ACM may help to reduce postoperative VAS ratings and may result in excellent bone quality available for implant placement.

Key words: Collagen membrane, ddACM, FDBA, Socket Preservation.

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Conflicts of interest:
The authors declare no conflicts of interest.

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ÉVALUATION DE LA MEMBRANE «CHORION AMNIOTIQUE» POUR LA PRÉSERVATION DE L'ALVÉOLE APRÈS L'EXTRACTION DES DENTS MAXILLAIRES À RACINE UNIQUE: UN ESSAI CLINIQUE CONTRÔLÉ RANDOMISÉ

Introduction: Le but de cette étude était d'évaluer l'efficacité de l'utilisation de la membrane chorion amnion désépithélialisée déshydratée (ddACM) sur la préservation de la cavité dans la région antérieure, cliniquement et radiographiquement.

Méthodes: 26 prémolaires maxillaires antérieures ou à racine unique non restaurables, avec fenestration buccale, ont été sélectionnées. La cavité a été remplie de matériau d'allogreffe et recouverte de ddACM pour le groupe d'étude, et la membrane de collagène pour le groupe témoin divisée également. Les paramètres cliniques, y compris la cicatrisation gingivale et l'épaisseur des tissus, ont été évalués. Le changement osseux volumétrique a été mesuré 4 mois plus tard à l'aide d'un CBCT.

Résultats: Le groupe d'étude a montré des résultats statistiques cliniques significatifs que le groupe témoin (valeur P = 0,020, ampleur de l'effet = 0,574) ainsi qu'une mesure de la largeur osseuse moyenne radiographique plus élevée que le groupe témoin après quatre mois (valeur P = 0,372, ampleur de l'effet = 0,357).

Conclusion: Par rapport à la membrane de collagène, l'ACM intentionnellement exposé est tout aussi efficace dans la préservation des crêtes. De plus, l'utilisation de MCA peut aider à réduire les cotes AVA postopératoires et peut entraîner une excellente qualité osseuse disponible pour la pose d'implants.

Mot-clés: Membrane de collagène, ddACM, FDBA, Socket Preservation.

Introduction

Many reasons can cause teeth loss including congenital absence, trauma, diseases of the dentition (e.g., caries, periodontal disease), mechanical failures or systemic

diseases. Hence, the importance of maintaining good oral hygiene, as well as overall health, cannot be overstated [1]. Because of the high rate of edentulous individuals, there is a significant increase in the use of dental implants [2]. The healing process of the edentulous ridge starts once the tooth has been extracted, which results in hard and soft tissue remodeling. Remodeling is a complex process involving structural, functional, and physiologic factors [3]. After an extraction, alveolar ridges resorb more rapidly during the first six months after extraction, than the resorption rate can reach 0.5–1.0% per year [3]. The alveolar ridge preservation (ARP) technique has been used for more than 20 years as a potent method of counteracting the reduction of the edentulous ridge [4] [5].

Ridge preservation is primarily about controlling alveolar ridge reduction during the healing process, ensuring that post-extraction resorption does not occur, the soft and hard tissues contour of the alveolar ridge are maintained, and bone formation is facilitated within the socket for placing a prosthetic driven implant as an ideal treatment [6]. ARP relies on grafting of the socket with biomaterials in order to ensure sustained bone levels [7]. Autogenous bone, demineralized freeze-dried bone allografts (DFDBA), xenografts, bioactive glass, hydroxyapatite, and calcium sulphate are among the grafting materials that are being used. Allografts or freeze-dried bone graft (FDBA) offers osteoinduction and conduction properties to the grafting location. Allografts reduces the complications correlated with autografts harvesting, thus supplying an infinite number of grafting materials [26].

The role of the membrane is to separate the grafted area from the integration of the epithelial gingival cells that would confine bone particles inhibiting the coupling of bone graft material into natural bone in the extraction site [8]. Bio-Gide® (from Geistlich, Switzerland) is a porcine-derived type I and type III collagen membrane that is not crosslinked. The membrane has a bi-layer structure that inhibits soft tissue ingrowth into the augmented site and degrades ideally to allow the cascade of biologic events leading to regeneration. Normally, the initial intentional closing of the wound, using any typical collagen membrane, is a must since [8] the membrane would resorbe faster when it comes into contact with saliva and bacteria found in the oral cavity. The approximation of the wound edges, however, results in a loss of keratinized tissues in that area. The allograft placental tissue could be a specific membrane with advantageous properties [9]. Human amnion chorion tissue holds anti-bacterial and antimicrobial abilities, reduces swelling at the wound site, and provides an abundant protein matrix to enhance cell proliferation [10]. Placental tissues were introduced to cover skin burns in the 90s, and in eye surgeries. In 2008 dentists started exploring placental tissues in daily work with the first freeze dried salable amnion chorion tissues [10,11].

Bioxclude TM, a resorbable dehydrated human de-epithelialized amnion-chorion membrane (ddACM), (Snoasis medical, USA with correlation of Community Tissue Service (CTS). Human amnion tissue, the internal layer of the placenta, includes collagen type III, IV, V, while chorion, the top layer of the placenta, contains collagen types I, III, IV, V, VI. Amnion has several distinctive features, like absence of antigenicity, antibacterial and non-inflammatory properties [12].

In order to advance our understanding of the potential advantageous of using ddACM compared to collagen membranes, this study pursues, how does the use of ddACM compare to collagen membrane in terms of soft tissue healing, patient pain levels, and gingival thickness in the procedure of socket preservation in maxillary single rooted teeth.

Materials and Methods

This study was approved by the ethical committee at Beirut Arab University

(Institutional Review Board of Beirut Arab University, IRB code: 2020- H-0083DM0422). Patients who needed extraction of un-restorable anterior or 2nd premolar single rooted maxillary teeth were conveniently recruited from the outpatient clinic of Oral Surgical Sciences Department, Faculty of Dentistry, Beirut Arab University, Beirut, Lebanon, fulfilling the inclusion & exclusion criteria;

Inclusion criteria were: Patients having un-restorable single rooted maxillary teeth needs extraction due to excessive tooth decay/ Failing endodontic treatment, /Vertical root fractures, /Mobile teeth. /Good oral hygiene, /age group 20 years old and above of both genders, / Socket type II, accessed using a periodontal probe and preoperative periapical x-rays according to [13]. Exclusion criteria: /Patients with uncontrolled systemic conditions, / Presence of acute infection in the site of extraction, /Pregnant or lactating women, /Patients having psychological problems, /uncontrolled periodontal diseases and conditions, /Heavy smokers >/20 cigarettes per day [27].

According to sample size calculation a total of 26 participant divided randomly by a randomizer into equal groups (13 in test group and 13 in control group). The participants were allocated either in test group (amnion chorion membrane, group 1) or control group (collagen membrane, group 2).

Preoperative phase

All patients were assessed and evaluated by proper history taking and thorough clinical and periapical x-rays examination (Figure 1, 2). An alginate impression was taken for the upper arch, before extraction. Wax up was done in cases of broken teeth to allow an acrylic stent fabrication in the lab, with a thermoplastic sheet, pressed over the cast using vacuum machine. Using a cylindrical bur 9 holes were done in the stent. Three holes at the mesial, three holes at the center, three holes at the distal. These holes were filled with radiopaque material such as gutta-percha, Bis-Gma acrylic resin, composite [15]. Patients were sent to the periodontology department to have a proper mechanical plaque removal, and were given oral hygiene instructions one week prior to surgery.

Operative phase (Figures 3-7)

All surgeries were performed by the same surgeon, and under sterile conditions. After betadine swabbing at the surgical site, local anesthesia Artinibsa 4%(Inibsa, Spain) blocks and infiltrations, were administered according to the tooth undergoing extraction.

Atraumatic extraction of the non-restorable tooth, using periotome inserted within the periodontal ligament space to cut the periodontal ligaments around the teeth prior to extraction and luxated till loose, and elevated or removed using forceps. A sulcular incision was made, and a full thickness muco-periosteal envelope flap reflected to allow access to the defected area of the buccal bone. The sockets were then curetted with surgical curette, CL866 (HU-FRIEDY, USA) to eliminate any residual or granulation tissues then they were irrigated with 0.9% normal saline solution and carefully inspected.

Cortical Mineralized/Demineralized Blend combines approximately 70% mineralized cortical bone with 30% demineralized cortical bone in an optimal mixture material with 0.25-1.00mm particle size placed in a sterile container and re-hydrated with normal saline for 3 minutes according to (Maxxeus dental, USA). For the test group sockets are bulked filled receiving extra thick layer buccally of allograft bone graft from (Maxxeus dental, USA) and covered with ddACM, BioXclude from (Snoasis medical, USA) over the crest adapted to extend on the buccal aspect without trimming of the membrane and tucked beneath the lingual tissue. While for the control group sockets are bulked filled buccally with allograft bone graft (Maxxeus dental by CTS, USA) and covered with collagen membrane Bio-Gide shape (Geistlich, Switzerland), without the need of trimming since it is prefabricated by the manufacturer into shape. Flap is then closed using 4/0 PTFE suture material by means of reverse X technique, and 2 interrupted sutures, one each at the distal and mesial papilla without attempting of primary closure.

Figure 1. Peri-apical x-ray of unrestorable 2nd premolar

Figure 2. Occlusal view pre-operative intra-oral image

Figure 3. Envelope flap design with no vertical release showing vertical root fracture with fenestration of buccal wall.

Figure 4. Allograft particles 70/30 blend deposited, over-bulking of the buccal plate.

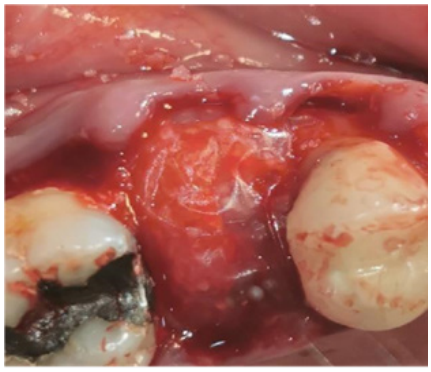

Figure 5. Amnion chorion membrane placed over bone graft material.

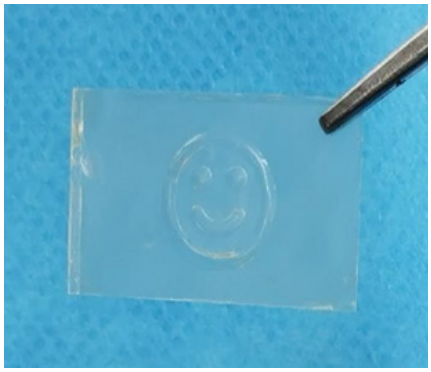

Figure 6. Amnion chorion membrane.

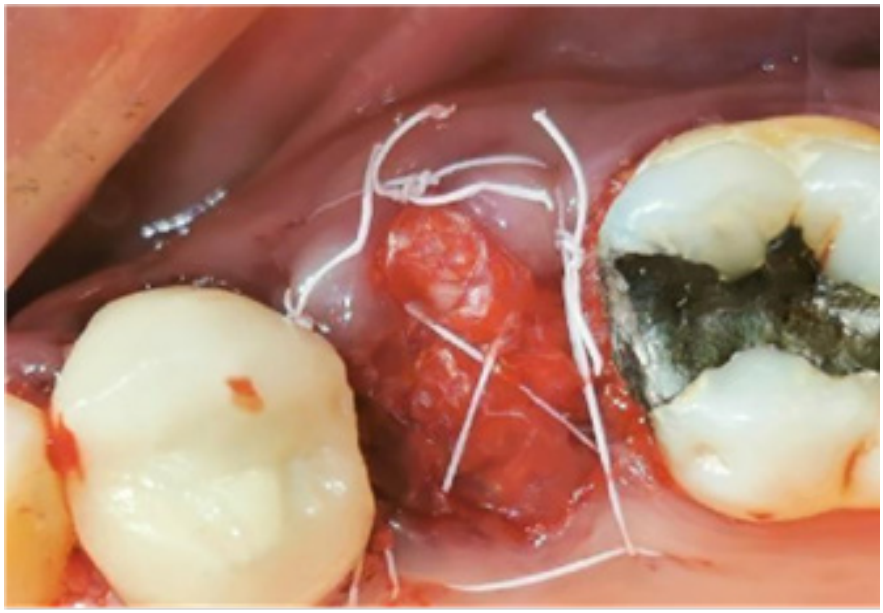

Figure 7. Occlusal view of flap closure using reverse X technique with 4/0 PTFE suture material, open socket.

Post-operative phase (Figures 8-14)

After the surgery, patients were given postoperative instructions. Patients in test group were also instructed not to rinse with chlorohexidine mouthwash but, with tap water, and not before the next three days, unlike the control group were asked to use chlorohexidine mouthwash. The following prescriptions was given containing antibiotic Augmentin 1g (GSK, UK) or erythromycin 500mg if penicillin allergic, NSAIDs (ibuprofen 600mg) for 7 days.

A CBCT was done immediately after bone graft as baseline measurements after insertion of the prefabricated acrylic stent. All patients were asked to come for follow-up on the 2nd day of surgery,7th, and the 14th day to evaluate the healing process, healing conditions were assessed visually by the operator according to Landry et al (Figure 8). healing index, and pictures were taken during follow-up days, where grades were given according to tissue color, suppuration, bleeding on probing, and granulation tissue [25].

The patients were given a printed visual assessment scale form (VAS) to record the pain level each day for the first two weeks on a scale of 0-10, and monitored by the operator on the days of follow up, and medication taken (Figure 9).

Grade	Remark
1.Very poor	Tissue color ≥50% gingiva red Response to palpation:bleeding Granulation tissue:present Suppuration:present
2.Poor	Tissue color ≥50% of gingiva red Response to palpation: bleeding Granulation tissue: present Suppuration:none
3.Good	Tissue color ≥25% but < 50% of gingiva red Response to palpation: no bleeding Granulation tissue:none Suppuration:none
4.Very good	Tissue color < 25% gingiva red Response to palpation: no bleeding Granulation tissue:none Suppuration:none
5.Excellent	Tissue color:all tissue is pink and healthy Response to palpation:no bleeding Granulation tissue: none Suppuration: none

Figure 8. Healing index of Landry, Turnbull and Howley (1988).

Figure 9. Visual Analog Scale Form 0-10 where 0 shows no pain & 10 is maximum.

Sutures were removed after 2 weeks of surgery.

At 4 months, patients were asked to do another CBCT for follow-up and measurements using the same prefabricated radiographic stent used before, in order to have standard measurements (Figures 15,16). Bucco-lingual measurements at the crest of the ridge were taken using the standard measuring tool in the cbct software, a line was drawn from the buccal aspect to the lingual aspect from where the radio-opaque points from the radiographic stent were visible and compared to the initial measurements from the first cbct which was done immediately after surgery [15,28]. A 4mm tissue punch was then taken from the site of surgery to evaluate amount of tissue thickness using a digital caliper.

Figure 10. 2nd day after surgery healing showing membrane stabilized and firm in place no signs of inflammation.

Figure 11. 7th day of healing after surgery, showing no signs of inflammation.

Figure 12. 14th day of healing, sutures removed, showing formation of new tissues.

Figure 13. 4 months after surgery showing complete healing of surgery site, and formation of keratinized tissues.

Figure 14. Readings on digital caliper showing amount of keratinized tissues after a punch taken from surgery site.

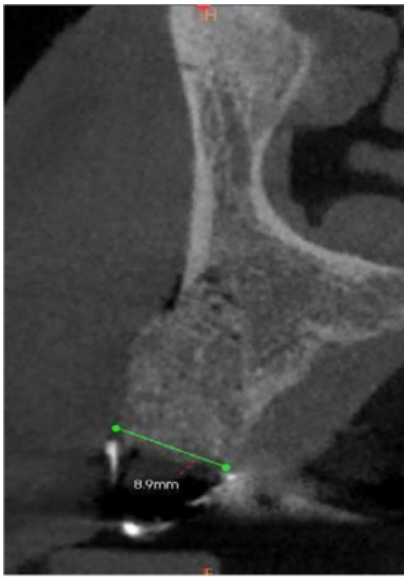

Figure 15. CBCT, para-axial cut (baseline).

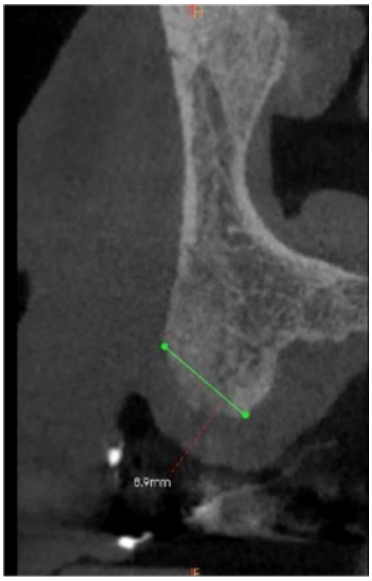

Figure 16. CBCT, para-axial cut 4 months' follow-up.

Statistical analysis was performed with IBM SPSS Statistics for Windows, Version 23.0. Armonk, NY: IBM Corp.

Nominal variables were presented as frequencies and percentages. Continuous variables were presented as frequencies, means and standard deviation. Bivariate analysis was conducted in order to evaluate both clinically and radiographically the use of amnion chorion membrane in socket preservation following extraction of maxillary single rooted teeth. The testing of the variables was conducted between the test group and the control group. The tests used were under non-parametric settings after normality test was done and taking into consideration the sample size (N=26).

Tests used were: Fisher's exact test used to test the difference between the test groups and the healing index (two nominal variables).

Student t test: used to compare tissue thickness between the two groups.

paired t test: used to compare between bone width at different time periods within each group. unpaired t test: used to compare between bone width in the two groups.

Friedman's test: used to study the changes by time in healing index within each group at different time. (non-parametric)

Mann-Whitney u test: used to test the difference between the study groups in function of the radiological measurements (continues variable not normally distributed). A difference is considered statistically significant if the p/value is less than 0.05

Results

Population

A total of twenty-six patients between males and females, were randomly selected to participate in this study into either group. 6 males and 7 females in the study groups having a mean ± SD age of 46.3±6.5 y, 5 males and 8 females in the control group, having a mean ± SD 47.8±9.3 y.

Clinical results

Healing index

At day two as well as day seven; there was no statistically significant difference between healing conditions in the two groups (*P*-value = 1, Effect size = 0.087) and (*P*value = 0.060, Effect size = 0.492), respectively.

At day 14, there was a statistically significant difference between healing conditions in the two groups (*P*-value = 0.020, Effect size = 0.574). Test group showed higher prevalence of good healing and lower prevalence of very good healing than control group. Both groups showed the same prevalence of excellent healing and no prevalence of poor healing (Table 1, Figure 17).

Changes within each group

As regards test group; there was a statistically significant change in healing conditions by time (*P*-value <0.001, Effect size = 0.905). There was a decrease in prevalence of poor healing after seven days and no cases had poor healing after 14 days. There was an increase in prevalence of good, very good and excellent healing after seven days as well as from seven to 14 days.

While for control group; there was also a statistically significant change in healing conditions by time (*P*-value <0.001, Effect size = 0.982). However, the pattern of change was different. Poor healing was only observed after two days and no cases had poor healing after seven as well as 14 days. There was an increase in prevalence of good healing after seven days and no cases had good healing after 14 days. There was an increase in prevalence of very good and excellent healing after seven days as well as from seven to 14 days.

Healing score (VAS)

When comparing between the two groups at day one, two, seven as well as day 14; there was no statistically significant difference between healing scores in the two groups (*P*-value = 0.282,

Effect size = 0.421), (*P*-value = 0.693, Effect size = 0.151), (*P*-value = 0.159, Effect size =

0.508) and (*P*-value = 1, Effect size = 0), respectively. (Table 2, Figure 18)

Changes in healing scores within each group

In both groups; there was a statistically significant change in healing scores by time (*P*-value <0.001, Effect size = 0.849) and (*P*-value <0.001, Effect size = 0.920), respectively. Pair-wise comparisons between time periods revealed that there was no statistically significant change in healing scores from day one to day two followed by a statistically significant decrease in healing scores from day two to day seven. There was no statistically significant change in healing scores from day seven to day fourteen.

Table 1: Frequencies (n), percentages (%) and results of Friedman's test for comparison between healing index at different time periods within each group.

Time	Healing index	Control (n = 13)		Test (n = 13)	
		N	%	N	%
Day 2	Poor	10	76.9	9	69.2
	Good	3	23.1	4	30.8
	Very good	0	0	0	0
	Excellent	0	0	0	0
Day 7	Poor	5	38.5	0	0
	Good	5	38.5	9	69.2
	Very good	3	23.1	4	30.8
	Excellent	0	0	0	0
Day 14	Poor	0	0	0	0
	Good	6	46.2	0	0
	Very good	4	30.8	10	76.9
	Excellent	3	23.1	3	23.1
P-value		<0.001*		<0.001*	
Effect size (v)		0.905		0.982	

*: *Significant at P ≤ 0.05*

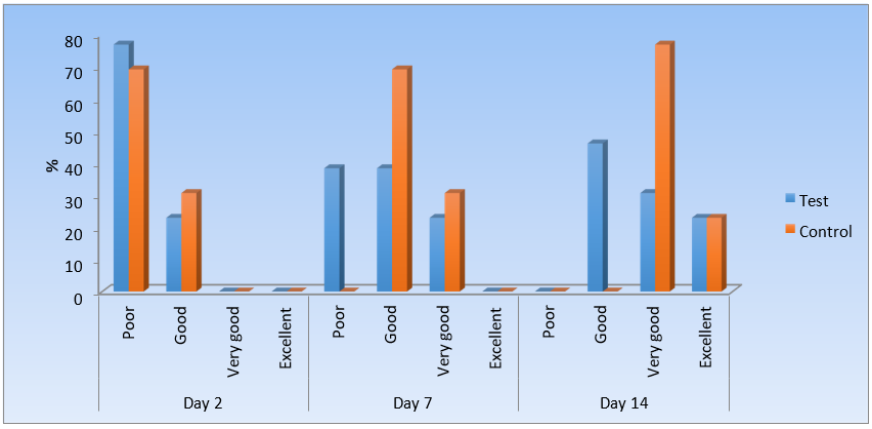

Figure 17: Bar chart representing healing conditions on the 2nd, 7th and 14th day between the test and control groups varying from poor to excellent.

Table 2: Descriptive statistics and results of Mann-Whitney U test for comparison between healing (VAS) scores in the two groups.

Time	Group	Median	Min.	Max.	Mean	SD	*P*-value	*Effect size (d)*
Day 1	Test	2	0	7	2.5	2.33	0.282	0.421
	Control	5	1	7	3.62	2.29		
Day 2	Test	2	0	4	1.73	1.2	0.693	0.151
	Control	1	0	7	2.12	2.32		
Day 7	Test	0.5	0	2.5	0.62	0.87	0.159	0.508
	Control	0	0	4	0.46	1.13		
Day 14	Test	0	0	0	0	0	1	0
	Control	0	0	0	0	0		

*: *Significant at* $P \leq 0.05$

Table3: Descriptive statistics and results of Friedman's test for comparison between pain (VAS) scores at different times within study group.

Time	Median	Min.	Max.	Mean	SD
Day 1	2 [A]	0	7	2.5	2.33
Day 2	2 [A]	0	4	1.73	1.2
Day 7	0.5 [B]	0	2.5	0.62	0.87
Day 14	0 [B]	0	0	0	0
P-value	<0.001*				
Effect size (w)	0.849				

*: *Significant at* $P \leq 0.05$, *Different superscripts indicate statistically significant change by time*

Table 4: Descriptive statistics and results of Friedman's test for comparison between pain (VAS) scores at different times within control group.

Time	Median	Min.	Max.	Mean	SD
Day 1	5 [A]	1	7	3.62	2.29
Day 2	1 [A]	0	7	2.12	2.32
Day 7	0 [B]	0	4	0.46	1.13
Day 14	0 [B]	0	0	0	0
P-value	<0.001*				
Effect size (w)	0.920				

*: *Significant at* $P \leq 0.05$, *Different superscripts indicate statistically significant change by time*

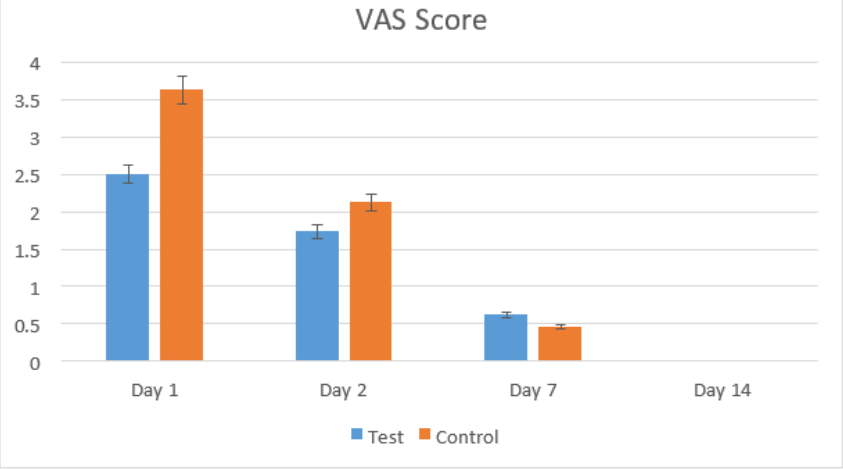

Figure 18: Bar chart representing median and range values for VAS from day 1 till day 14 between the test and control group

Tissue thickness (mm)

There was no statistically significant difference between mean tissue thicknesses in the two groups (*P*-value = 0.093, Effect size = 0.686), where mean ± SD for the test group was

2.23 ± 0.21, and 2.38±0.22 for mean ± SD control group. (Table 5, Figure 19).

Radiographic results

While comparing bone width measurements in (mm) between the two groups at base line as well as after four months, test group showed statistically significantly higher mean bone width measurements than control group (*P*-value = 0.007, Effect size = 0.266) and (*P*-value = 0.030, Effect size = 0.181), respectively, showing mean ± SD

9.13 ± 0.72 at baseline & 6.44 ± 0.68 at 4 months' follow-up for the test group. While in the control group showing mean ± SD value of

8.36 ± 0.6 at baseline & 5.87 ± 0.58 after 4 months. (Table 6).

Changes within each group

In both groups; there was a statistically significant decrease in mean bone width after four months (*P*-value <0.001, Effect size = 0.926) and (*P*-value <0.001, Effect size = 0.915), respectively. (Table 7, Figure 20).

Comparison between amounts of change in bone width in the two groups after four months

The amount of change was calculated as: *Bone width (Base line) – Bone width (4 months)* There was no statistically significant difference between mean amounts of change in bone width in the two groups (*P*-value = 0.372, Effect size = 0.357). having mean ± SD value 2.69 ± 0.53 for test group, & 2.49± 0.59 for the control group.(Table 8, Figure 21).

Table 5: Descriptive statistics and results of Student's t-test for comparison between tissue thickness (mm) in the two groups.

Test (n = 13)		Control (n = 13)		*P*-value	*Effect size (d)*
Mean	SD	Mean	SD		
2.23	0.21	2.38	0.22	0.093	0.686

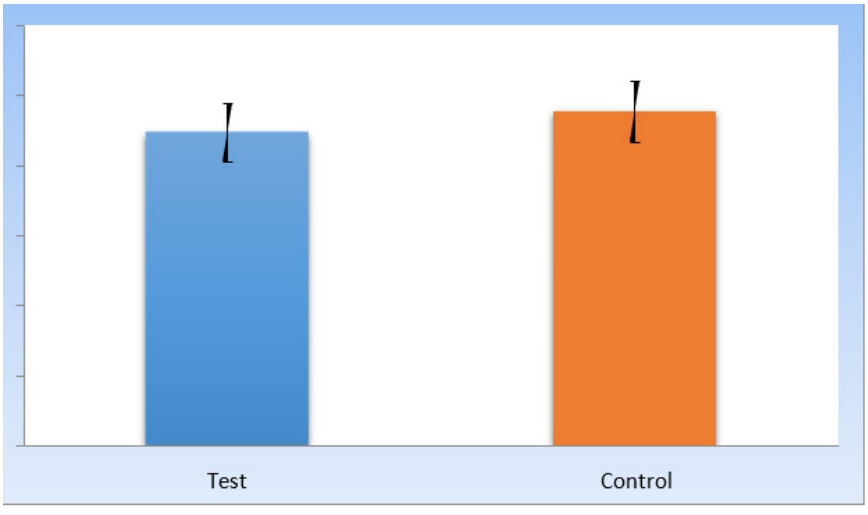

Figure 19: Bar chart representing mean and standard deviation values for tissue thickness in the test and control group.

Discussion

In this study, we have clinically and radiographically evaluated the effects generated by using two different membranes namely amnion chorion membrane (ACM) and collagen membrane. The membranes were placed over allograft (FDBA) in socket preservation procedure following atraumatic extraction of single-rooted maxillary. The study was limited to single rooted teeth anterior or premolars to decrease the heterogeneity of anatomical sites. This should result in similar amounts (mm) of membrane exposed to the oral environment after site closure between the control and test arm since the dimensions of teeth differ according to the site. This study was also limited to socket type II since including type I sockets with intact bony walls greatly increases

Table 6: Descriptive statistics and results of repeated measures un-paired t test for comparison between bone width measurements (mm) in the two groups.

Time	Test (n = 13)		Control (n = 13)		P-value	Effect size (Partial squared)	Eta
	Mean	SD	Mean	SD			
Base line	9.13	0.72	8.36	0.6	0.007*	0.266	
4 months	6.44	0.68	5.87	0.58	0.030*	0.181	

*: Significant at $P \leq 0.05$

Table 7: Descriptive statistics and results of repeated measures paired t test for comparison between bone width (mm) at different time periods within each group.

Time	Test (n = 13)		Control (n = 13)		P-value	Effect size (Partial squared)	Eta
	Mean	SD	Mean	SD			
Base line	9.13	0.72	8.36	0.6	0.007*	0.266	
4 months	6.44	0.68	5.87	0.58	0.030*	0.181	

*: Significant at $P \leq 0.05$

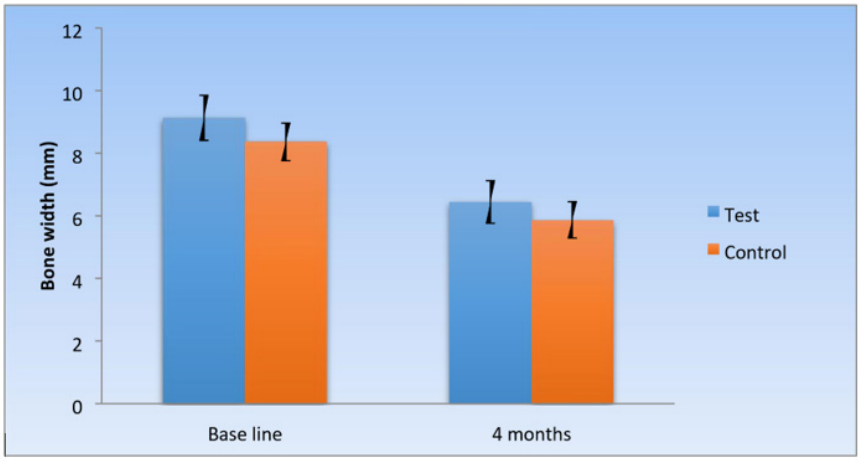

Figure 20: Bar chart representing mean and standard deviation values for bone width measurements between test and control group at baseline and after 4 months.

Table 8: Descriptive statistics and results of Student's t-test for comparison between amounts of change in bone width (mm) in the two groups.

Test (n = 13)		Control (n = 13)		*P*-value	*Effect size (d)*
Mean	**SD**	**Mean**	**SD**		
2.69	**0.53**	**2.49**	**0.59**	**0.372**	**0.357**

**: Significant at P ≤ 0.05*

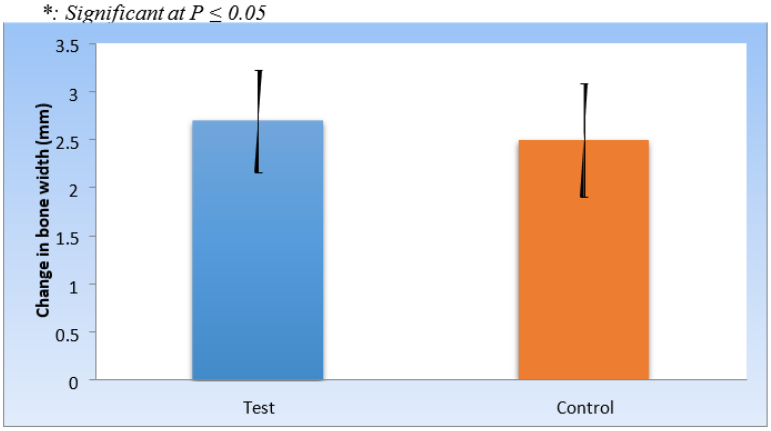

Figure 21: Bar chart representing mean and standard deviation values for amounts of change in bone width between the test group and control group.

the likelihood that research will not capture any statistically significant differences between the control and test arms for alveolar ridge width measurements and type III needs soft and hard tissue grafting. Over bulking the socket with grafting material buccally according to may prevent resorption [16].

As mentioned by in a systemic review that alveolar ridge preservation using various bone substitutes is an efficient strategy for reducing the physiological resorption process following tooth extraction [17]. Moreover, there were only minor changes in resorption rates across allogeneic, xenogeneic, and alloplastic grafting materials. Also stated in a systematic review presents up-to date data on the efficiency of several bone material replacements for alveolar preservation following tooth extraction, in general, bone-replacement materials are excellent in reducing alveolar alterations following tooth extraction [18].

Using of ddACM, as well as a minimally invasive surgical method, decreases inflammation and discomfort while improving open-socket grafting recovery. DdACM is a significant advancement in socket grafting, showing accelerated healing capabilities in both soft and hard tissue [19].

Porcine-derived CMs have been produced as soft tissue replacements to widen keratinized gingiva. They were proven to be just as successful and predictable as connective tissue grafts, but with much less patient morbidity. They also improved color matching and reduced wound sensitivity as compared to spontaneous healing. Clinically and histologically, few granules of biomaterial surrounded by soft tissue have been detected in certain specimens, probably due to fast CM resorption during the first two weeks of recovery [20].

While using a coronally advanced flap design to protect the socket, the open barrier membrane approach was adopted to prevent future mucogingival difficulties with primary closure [12].

Due of its adherence and quick wound regeneration, the dehydrated human amnion/chorion membrane (ddACM) outperforms other commonly used similar membranes in wound closure. These combined properties explain why the amniotic membrane can aid in epithelial repair. The oral epithelium generates a variety of growth factors, and the basement membrane promotes epithelial cell migration, which strengthens basal epithelial cell adhesion and may promote epithelial differentiation. According to the manufacturer ddACM antimicrobial properties between different placental and collagen membranes, a distinct "zone of inhibition" was seen surrounding the BioXclude disc, showing that the membrane contains soluble substances that inhibit bacterial growth even at a distance from the membrane as seen also [21].

Corresponding to this study, there was no statistically significant difference between the study and control groups regarding gingival thickness. Fast development of keratinized tissue and tissue growth over extraction sockets is well documented by [21] showing tissue expansion of dental socket extraction using dehydrated amnion chorion membrane done in 2018, due to the presence of fibroblast growth factors present in the membrane, there was evidence of keratinized tissue formation. This might be due to direct cell proliferation over the membrane rather than cell crossing from the buccal and lingual margins. Because of these properties, patients in study group instructed not to rinse with any mouthwash containing chlorhexidine except with tap water, and not before 3 days after surgery in order not to disturb the membrane and preventing new fibroblasts formation. While control group is instructed to use chlorhexidine mouthwash to prevent infection while the exposed wound heals.

These results matched those of [22], who compared histologically the formation of new bone using amnion chorion membrane versus resorbable collagen barrier. All of the subjects healing went smoothly and uneventfully with no side effects, as mentioned by him "In fact, inflammation in the amnion group was a little higher than in the control group, but this does not interrupt bone formation, and some mild inflammation is useful for bone regeneration."

After 14 days of the procedure, a statistically significant difference

was found between the two groups. Test group showed higher good healing conditions than the control group. Within the test group a significant statistical difference there was an increase of healing conditions from good to very good to excellent from day 7 till day 14. Unlike the control group where there was a significant statistical difference but with a different pattern. Where only poor healing was seen after 2 days of surgery, with increased prevalence of good healing after 7 days and excellent healing after 14 days.

According to this study, there was no significant statistical difference between healing score in the two groups from day 0 till day 14. But a significant statistical difference was seen from day 2 till day 7.

In a similar study where the author was assessing socket preservation using bioxclude versus biogide found that after 18-20 weeks after extraction, ridge preservation with FDBA using either BioGide® or BioXclude® membrane resulted in horizontal ridge loss of 2.0mm and vertical ridge dimension loss of 1.0mm [23].

Radiographic follow up was made after 4 months postoperatively. There was statistically significant difference between the two groups concerning amount of bone width change favoring the test group, showing better bone width. [24].

Conclusion

ARP treatment, which included socket grafting and socket sealing, resulted in enhanced alveolar bone maintenance up to 4 months following tooth extraction and decreased the need for bone augmentation with simultaneous implant implantation. Both amnion chorion membrane and collagen membrane showed significant results displayed in clinical and radiographic effectiveness in developing adequate bone wide and thick keratinized tissue, yet no difference was found between them. The approach of over-bulking the buccal plate used counteracted against resorption of allograft. However, ridge preservation without primary closure preserved the buccal keratinized tissue much better and reduced postoperative pain.

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