Comparative Effectiveness of PROMOGRAN PRISMA™ Matrix Versus a Bovine Collagen Extracellular Matrix in Surgical and Traumatic Wounds

Amy Law, MBA

Vice President, Global Health Economics, Reimbursement and Government Affairs

Amy Law joined Acelity eleven years ago, and has held various roles in Marketing, IT and Operations. She currently leads Global Health Economics Outcomes Research, Reimbursement and Government Affairs. Her team is focused on real world evidence development to help secure market access and reimbursement for Acelity's portfolio. She also works actively with partners in DC to secure policies that foster innovation and quality patient outcomes in wound care. Prior to joining Acelity, she was a management consultant, leading engagements in South Korea, Germany, Australia, and the US. Amy holds a degree in Economics from the London School of Economics and an MBA from Harvard Business School.

Leah Griffin, MS

Leah Griffin is a biostatistician and outcomes researcher with expertise in global healthcare, health economics, and outcomes research. She is a published author and an experienced health and industry expert with over 16 years of thought leadership and hands-on experience in clinical and economic analyses. At the start of her career, she spent 11 years as a biostatistician at Wake Forest University Baptist Medical Center, where she developed expert knowledge in conducting and administering randomized controlled trials and clinical outcomes research. Leah has been with KCI for 5 years where she has focused on the expansion of the body of supporting clinical and economic evidence. Leah commands comprehensive knowledge and expertise in research design, study development and analysis methodology.

ABSTRACT

BACKGROUND

Complications in the healing of acute wounds may yield challenges to wound management and impact healthcare cost-containment. This study presents a comparative-effectiveness study to evaluate the value proposition of 2 collagen-containing wound dressings: PROMOGRAN PRISMA™ Matrix and a bovine collagen extracellular matrix (ECM) in matched cohorts of patients undergoing treatment for surgical or traumatic wounds.

METHODS

Data extracted from the US Wound Registry identified patients with surgical or traumatic wounds treated with either dressing and included patients with complete data records (n = 6044). Twenty-nine variables including age, BMI, tobacco use, and diabetes were considered in propensity score matching to develop a case-matched cohort of 664 patients (n = 332 patients/product group). Two-sample t-tests were used for continuous variables, and Chi-Square or Fisher's exact test was used for categorical

RESULTS

A significantly higher percentage of the PROMOGRAN PRISMA™ Matrix reached 75%-100% granulation with zero depth as compared to the ECM group (83.5% vs. 67.0%, p<0.0001). The PROMOGRAN PRISMA™ Matrix group had significantly higher numbers of wounds reaching 75%-100% granulation at 8 weeks (p=0.0063), 12 weeks (p=0.0010), 16 weeks (p=0.0002) and 20 weeks (p=0.0002). There was no difference in the number of dressing applications between the two cohorts. However, the duration of dressing use was significantly longer in the PROMOGRAN PRISMA™ Matrix group (12.8 days vs. 8.9 days, p=0.0210), and there were more days between dressing changes (3.5 days v. 2.3 days, p=0.0012).

CONCLUSIONS

PROMOGRAN PRISMA™ Matrix appears to offer afford improved healing rates and reduced time to granulation relative to bovine collagen ECM dressings in high-risk patients with surgical or traumatic wounds.

INTRODUCTION

The popularity of collagen for wound healing and cosmetic surgeries is fueling forecasted market compound annual growth rate of 5.23% through 2023.[1] As collagen dressing use increases, evaluation of real-world evidence to assess differences between products can benefit healthcare providers. This study evaluated the value of two collagen-containing wound dressings: PROMOGRAN PRISMA™ Matrix and bovine collagen extracellular matrix (ECM, PURACOL® Microscaffold™ Collagen Wound Dressing, Medline Industries, Inc., Northfield, IL) in matched cohorts of patients undergoing treatment for acute and surgical wounds.

METHODS

An electronic healthcare database (United States Wound Registry or [USWR]) was used to identify acute and surgical wounds with complete data records who received either bovine collagen ECM (control) or PROMOGRAN PRISMA™ Matrix (ORC). Propensity score matching across 29 variables was performed to construct a case-matched cohort **(Table 1)**.[2] A logistic regression model was used to model treatment (ORC or control) as the outcome

with 29 variables included in the model. The predicted values from the logistic regression model were the propensity scores. Nearest neighbor matching was used to find 1:1 matches between the PROMOGRAN PRISMA™ Matrix and control cohorts. The subsequent matched cohorts were then compared. Two-sample t-tests were used for continuous variables, and Chi-Square or Fisher's exact test was used for categorical variables to compare PROMOGRAN PRISMA™ Matrix and bovine collagen ECM post-matching.

RESULTS

Patient demographics and baseline wound characteristics were similar between the control and ORC groups **(Tables 2-4).** Patients included in this study had an average of >4 comorbidities including diabetes (30%) and hypertension (66%). Wounds were a median size of 3 cm^2 and approximately two weeks old at the time of presentation. Length of follow-up was up to 16 weeks, and included initial clinic visit to final clinic visit. There were no significant differences in length of follow-up between the two cohorts with median (IQR) of 58.5 days (28.5, 126) for PROMOGRAN PRISMA™ Matrix and 55.0 (28-122) for control (p=0.2505).

The patterns of collagen use are reported in **Table 5**. PROMOGRAN PRISMA™ Matrix was used for a significantly longer duration (time between first and last dressing application) than the control dressing (12.8 days vs. 8.9 days, p=0.021). There was also a significant difference in the application rate (days between collagen applications) with ORC applied every 3.5 days, and ECM changed every 2.3 days (p=0.0012). There were no significant differences in the time to the first collagen application, number of applications, or duration of collagen use in patients with healed wounds.

When evaluated as healed or not healed at last clinic visit as the outcome of interest, there was a significant difference between the cohorts with 56.3% of ORC wounds healed versus 39.8% of control wounds healed (p<0.0001) **(Table 6)**. The final area of the wound was smaller in the ORC group 0.11cm^2) than the control group (0.15cm^2, although this did not reach significance (p=0.0957). A significantly higher percentage of wounds in the ORC group reached 75%-100% granulation with zero depth compared to the control group (83.5% vs. 67.0%, p<0.0001). Additionally, statistically significant differences were found in the percentage of wounds reaching 75%-100% granulation at 8 weeks (p=0.0063), 12 weeks (p=0.0010), 16 weeks (p=0.0002) and 20 weeks (p=0.0002), with higher percentages recorded in the ORC group **(Figure 1).**

TABLE 1. VARIABLES USED FOR PROPENSITY SCORE MATCHING

Variables Assessed	
Gender	Strong anticoagulant medication
Race	Anticoagulant medication
Age at first treatment	Antiplatelet medication
Body mass index	Plavix or Pletal medication
Tobacco use	Prednisone medication
Diabetes	Antirejection medication
History of arterial vascular disease	Immunosuppressive medication
Hypertension	Area of wound at first visit before any debridement
Renal dialysis	Area of wound at first visit after any debridement
Autoimmune disease	Wound age at first clinic visit
Treated for peripheral vascular disease	Wound healing index
Peripheral vascular disease	Initial depth at muscle, tendon, or bone
Endovascular disease	Initial granulation score
Unique medication count	
Unique prescription medication count	

TABLE 2. PATIENT DEMOGRAPHICS

PATIENT DEMOGRAPHICS	Control N=332	ORC N=332	p-value
Age (years, mean ± sd)	63.8 ± 18.7	62.7 ± 17.3	0.4152
BMI (kg/m^2, median, IQR)	30.9 (24.5, 36.2)	29.5 (24.5, 34.9)	0.3431
Gender (n, %)			
Male	147 (44.3%)	156 (47.0%)	0.4832
Female	185 (55.7%)	176 (53.0%)	
Race (n, %)			
Caucasian	274 (82.8%)	260 (78.3%)	0.1592
Hispanic	11 (3.3%)	9 (2.7%)	
Native American	3 (0.9%)	8 (2.4%)	
African American	18 (5.4%)	33 (9.9%)	
Asian	1 (0.3%)	2 (0.6%)	
Other	24 (7.3%)	20 (6.0%)	

ORC= PROMOGRAN PRISMA™ Matrix; SD= standard deviation; IQR= Interquartile range

TABLE 3: PATIENT COMORBIDITIES

PATIENT DEMOGRAPHICS	Control N=332	ORC N=332	p-value
Tobacco Use (Current Smoker)	53 (16.0%)	49 (14.8%)	0.6668
Type 2 Diabetes	99 (29.8%)	118 (35.5%)	0.1159
Arterial Vascular Disease	54 (16.3%)	51 (15.4%)	0.7497
Vascular Disease	70 (21.1%)	67 (20.2%)	0.7736
Hypertension	221 (66.6%)	221 (66.6%)	1.0000
Autoimmune Disease	35 (10.5%)	26 (7.8%)	0.2824
Peripheral Vascular Disease	19 (5.7%)	21 (6.3%)	0.7443
Anticoagulation Medication	141 (42.5%)	120 (36.1%)	0.1120
Antiplatelet Medication	152 (45.8%)	134 (40.4%)	0.1827
Immunosuppressive Medications	71 (21.4%)	79 (23.8%)	0.4578
Number of Comorbidities (mean ± SD)	4.2 ± 2.5	4.1 ± 2.4	0.6811

ORC= PROMOGRAN PRISMA™ Matrix; SD= standard deviation; IQR= Interquartile range

TABLE 4. BASELINE WOUND CHARACTERISTICS

PATIENT DEMOGRAPHICS	Control N=332	ORC N=332	p-value
Initial Area (cm^2) (median, IQR)	3 (0.8, 10.4)	3 (0.8, 9.9)	0.8256
Wound Age at Presentation (days, medial, IQR)	14 (4, 34)	15 (4, 41.5)	0.5703
WHI (mean ± SD)	75.6 ± 13.0	75.2 ± 15.0	0.1296
Initial Granulation (n, %)			
≥75% and no depth	36 (10.8%)	35 (10.5%)	0.8235
≥75%	7 (2.1%)	4 (1.2%)	
25-75% or has red moist tissue	2 (0.6%)	1 (0.3%)	
<25% or dry dark red/pink/poor quality	254 (76.5%)	254 (76.51%)	
Approximately 0%	33 (9.9%)	38 (11.5%)	

ORC= PROMOGRAN PRISMA™ Matrix; SD= standard deviation; IQR= Interquartile range

DISCUSSION

While much of the literature is focused on the use of collagen dressings to jump-start stalled or chronic wounds, they can also play a key role in healing surgical wounds (including deep surgical debridement or amputation of a formerly chronic wound) and traumatic wounds, particularly for patients where multiple comorbidities are present and the risk of wound breakdown is higher. In this patient population, these factors likely influenced the practitioner's decision to use collagen.

Although the study results suggest the majority of patients achieve 75-100% granulation by eight weeks, the relatively low percentage of patients designated as healed at the time of last clinic visit supports discussions about the low real-world healing rates of highly compromised patients.[3] This finding may also support the argument that complete wound closure may not always be an appropriate endpoint in clinical studies and brings forward the relevance of other options such as patient-centered endpoints and alternate clinical endpoints aimed at wound volume reduction over time.[4] Overall, this comparative effectiveness study found that PROMOGRAN PRISMA™ Matrix appears to afford improved healing rates and reduced time to granulation relative to the bovine collagen ECM control dressing in high-risk patients with surgical and traumatic wounds.

References

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TABLE 5: PATTERN OF COLLAGEN USE

PATIENT DEMOGRAPHICS		Control N=332	ORC N=332	p-value
Time to first application (days)	Median (IQR)	14 (0, 34.5)	12 (0, 28)	0.2995
Time between first and last application (days)	Median (IQR)	8.9 (0, 27.6)	12.8 (0, 29.5)	0.0210
Number of Applications	Median (IQR)	3 (2, 6)	3 (2, 5)	0.2318
Application Rate (days between)	Median (IQR)	2.3 (0, 4.7)	3.5 (0, 7)	0.0012
Duration of collagen use in healed wounds	Median (IQR)	12 (0, 28.9)	14 (0, 46.1)	0.1835

TABLE 6. WOUND OUTCOMES

Wound Outcomes	Control N=332	ORC N=332	p-value
Healed (n,%)	132 (39.8%)	187 (56.3%)	<0.0001
Not Healed (n, %)	200 (60.2%)	145 (43.7%)	
Final area (cm2, median, IQR)	0.15 (0, 1.12)	0.11 (0, 0.80)	0.0957
Amount of Granulation (n,%)	N=294	N=296	
Reached 75-100% Granulation and no depth	197 (67.0%)	247 (83.5%)	<0.0001
75-100% Granulation at 4 weeks	101 (34.4%)	121 (40.9%)	0.1019
75-100% Granulation at 8 weeks	151 (51.4%)	185 (62.5%)	0.0063
75-100% Granulation at 12 weeks	164 (55.8%)	204 (68.9%)	0.0010
75-100% Granulation at 16 weeks	172 (58.5%)	216 (73.0%)	0.0002
75-100% Granulation at 20 weeks	180 (61.2%)	224 (75.7%)	0.0002

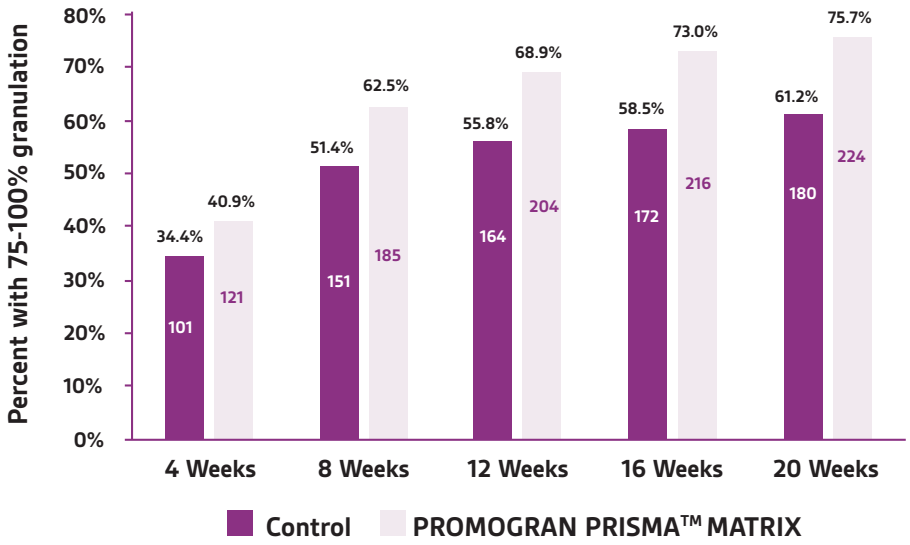

Figure 1. Percentage of wounds reaching 75%-100% granulation tissue. Dark purple bar represents the control group; light purple bar represents PROMOGRAN PRISMA™ Matrix group.