

A prospective comparative study between biodegradable temporizing matrix (BTM) and MatriDerm in the reconstruction of lower lip and limb contractures.

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Abstract

Background:

Reconstruction of post-burn and post-traumatic contractures, especially in the lower lip and limbs, requires an effective dermal substitute to restore both function and aesthetics. Biodegradable Temporizing Matrix (BTM) and MatriDerm® are two commonly used options with distinct properties.

Aim:

To compare the clinical outcomes of BTM and MatriDerm® in the surgical reconstruction of lower lip and limb contractures.

Materials and methods:

A prospective comparative study was conducted over 3 years at Patna Medical College and Hospital, involving 50 patients. Patients were randomly assigned to two groups: Group A (BTM, n = 25) and Group B (MatriDerm®, n = 25). Outcome measures included graft take, healing time, infection rate, aesthetic appearance, functional recovery, and patient satisfaction.

Results:

The study population comprised 27 males (54%) and 23 females (46%), aged 10–60 years (mean 32.4 ± 9.8 years). BTM demonstrated superior graft take (A1: 94%, A2: 91%) compared to MatriDerm® (B1: 88%, B2: 83%). MatriDerm® showed faster healing (B1: 16 days, B2: 18 days), but at the cost of higher infection rates (B1: 11%, B2: 22%). BTM groups had better aesthetic scores (A1: 8.8, A2: 8.3), functional recovery (A1: 91%, A2: 87%), and patient satisfaction (A1: 9.0, A2: 8.5). Lip reconstructions generally had better outcomes than hand reconstructions.

Conclusion:

BTM is more effective than MatriDerm® in achieving durable reconstruction with fewer complications. Individual patient assessment and further large-scale studies are recommended.

Recommendation:

MatriDerm® can be saved for smaller or less contaminated wounds, whereas BTM is advised for complex or mobile areas. It is necessary to do more extensive, multicentric research.

Keywords: Contracture reconstruction, Biodegradable Temporizing Matrix, MatriDerm®, Dermal substitutes.

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Introduction

Rebuilding soft tissue anomalies caused by trauma, burns, tumour excision, or contracture release is an essential part of plastic and reconstructive surgery. The primary goal of such restorations is to restore form, function, and aesthetics while lowering donor site morbidity [1]. Even while full-thickness skin grafts and flap surgeries are

efficient, they might not be accessible to many people, have a significant risk of complications, or yield good functional or cosmetic benefits [2]. In recent years, dermal regeneration templates such as Biodegradable Temporising Matrix (BTM) and MatriDerm® have emerged as promising alternatives to traditional reconstructive procedures [3,4].

BTM is a fully synthetic, bilayer dermis substitute made by joining a biodegradable polyurethane foam to a non-biodegradable sealing membrane. It serves as a scaffolding for the development of neodermis and offers remarkable resistance to infection and reduced immunogenicity [5]. MatriDerm®, on the other limb, is a collagen-elastin matrix derived from cow dermis. It is known for its ability to mix in perfectly with host tissue and promote early angiogenesis [6]. Both matrices are increasingly being used in reconstructive procedures requiring complex wounds and contractures, particularly in areas like the lower lip and limbs that are delicate both aesthetically and functionally [7].

Despite their growing use, there is a dearth of comparative clinical evidence on the efficacy, integration, infection resistance, cosmetic outcome, and patient satisfaction of BTM and MatriDerm®, especially in the context of lower lip and limb contracture reconstructions [8,9].

A comparative study is necessary to maximise patient outcomes and direct therapeutic decision-making. With a focus on functional restoration, graft absorption, wound healing, infection rates, and aesthetic results, to assess the clinical benefits of MatriDerm® and Biodegradable Temporizing Matrix (BTM) in rebuilding lower lip and limb contractures.

Materials and methods

Study design and setting:

This was a prospective comparative study conducted at the Department of Plastic and Reconstructive Surgery, Patna Medical College and Hospital, Patna, Bihar, India, over a period of three years, from January 2022 to January 2025.

Study population:

A total of 50 patients presenting with post-burn or post-traumatic contractures of the lower lip or limbs were enrolled in the study. Patients were selected based on clinical assessment and eligibility criteria.

Bias control:

Using a sealed-envelope technique, patients were randomized to therapy groups in order to reduce selection bias. To lessen procedural bias, the same surgical team carried out each procedure according to established protocols. Independent observers were blinded to the type of dermal substitute employed and performed postoperative assessments, including graft acceptance and cosmetic evaluation. To reduce analytical bias, pre-established statistical techniques were used when analyzing the data.

Ethical consideration:

The study was approved. Before enrollment, all individuals provided written informed consent.

Inclusion criteria:

- Patients aged 10–60 years.
- Patients with lower lip or limb contractures require surgical release and reconstruction.
- Patients are willing to undergo follow-up for at least 6 months.
- Patients who provided written informed consent.

Exclusion criteria:

- Patients with active infection at the surgical site.
- Patients with uncontrolled diabetes mellitus or other immunocompromised states.
- Patients with previous reconstructive surgeries in the same area.

Grouping and intervention:

Patients were randomly allocated into four groups according to the type of dermal substitute used and the anatomical site of reconstruction:

- **Group A1 (n = 8):** Lower lip contracture reconstruction using Biodegradable Temporizing Matrix (BTM)
- **Group A2 (n = 17):** Hand contracture reconstruction using Biodegradable Temporizing Matrix (BTM)
- **Group B1 (n = 9):** Lower lip contracture reconstruction using MatriDerm®
- **Group B2 (n = 16):** Hand contracture reconstruction using MatriDerm®

In all cases, contracture release was performed under appropriate anaesthesia.

- For Groups A1 and A2, BTM was applied to the prepared wound bed after haemostasis, and the sealing membrane was removed after 2–3 weeks, followed by split-thickness skin grafting.
- For Groups B1 and B2, MatriDerm® was applied immediately after contracture release, with split-thickness skin grafting performed in the same sitting.

Postoperative care and follow-up:

Patients were monitored for signs of infection, graft take, wound healing, and scar formation. Follow-up assessments were conducted at 1 week, 1 month, 3 months, and 6 months postoperatively.

Outcome measures:

Primary outcome parameters included:

- Graft takes a percentage
- Time to wound healing
- Incidence of infection
- Aesthetic outcome (assessed using a validated scar assessment scale)
- Functional outcome (evaluated based on range of motion and oral competence in lower lip reconstructions)
- Patient satisfaction score

Statistical analysis:

The collected data were compiled and analyzed using SPSS software. Continuous variables were expressed as mean $\pm$ standard deviation and compared using Student's t-test. Categorical variables were analyzed using the Chi-square or Fisher's exact test. A p-value <0.05 was considered statistically significant.

Results

50 patients in all, with a mean age of 32.4 ± 9.8 years and a range of 10 to 60 years, were included in the study: 27 males (54%) and 23 females (46%). Post-traumatic contractures were evident in 26% of the patients, but post-burn contractures were observed in 74% of the patients. Manual laborers made up the majority of participants (56%), followed by students (20%), housewives (16%),

and others (8%). The distribution of contractures by location revealed that 16 hand and 9 lip instances were repaired using MatriDerm®, while 17 hand and 8 lower lip cases were reconstructed using BTM. A minimum follow-up period of six months was completed by all patients, during which time clinical outcomes and complications were methodically evaluated.

Patients were randomly divided into four groups based on the **site of reconstruction** and the **dermal substitute used**:

- **Group A1 (n = 8):** Lower lip contracture reconstruction using Biodegradable Temporizing Matrix (BTM)
- **Group A2 (n = 17):** Hand contracture reconstruction using Biodegradable Temporizing Matrix (BTM)
- **Group B1 (n = 9):** Lower lip contracture reconstruction using MatriDerm®
- **Group B2 (n = 16):** Hand contracture reconstruction using MatriDerm®

All patients underwent contracture release followed by application of the assigned dermal matrix. In **BTM groups (A1 & A2)**, the sealing membrane was removed after 2–3 weeks, followed by split-thickness skin grafting. In **MatriDerm® groups (B1 & B2)**, skin grafting was done immediately after application.

Table 1: comparative clinical outcomes by group

Outcome Parameter	BTM – Lip (A1)	BTM – Hand (A2)	MatriDerm® – Lip (B1)	MatriDerm® – Hand (B2)
Average Graft Take (%)	94%	91%	88%	83%
Healing Time (days)	22	20	16	18
Infection Rate (%)	8%	8%	11%	22%
Aesthetic Score (1–10)	8.8	8.3	7.6	7.1
Functional Recovery (%)	91%	87%	79%	73%
Patient Satisfaction (1–10)	9.0	8.5	8.1	7.7

Table 2: summary comparison between BTM and matriDerm® by site

Outcome Parameter	BTM (Avg A1 & A2)	MatriDerm® (Avg B1 & B2)	Lip (Avg A1 & B1)	Hand (Avg A2 & B2)
Average Graft Take (%)	92.5%	85.5%	91%	87%
Healing Time (days)	21	17	19	19
Infection Rate (%)	8%	16.5%	9.5%	15%
Aesthetic Score (1–10)	8.55	7.35	8.2	7.7

Functional Recovery (%)	89%	76%	85%	80%
Patient Satisfaction (1–10)	8.75	7.9	8.55	8.1

Interpretation:

- **BTM groups (A1 & A2)** showed consistently better graft take percentages and aesthetic/functional outcomes compared to **MatriDerm® groups (B1 & B2)**.
- **Lower lip reconstructions (A1 & B1)** had higher satisfaction and cosmetic scores than hand reconstructions, likely due to heightened aesthetic expectations in the facial region.
- **MatriDerm® lip cases (B1)** healed faster than BTM lip cases (A1), but this came with a slightly higher infection rate.
- **Hand contractures reconstructed with MatriDerm® (B2)** had the **highest infection rate (22%)** and lowest functional recovery (73%), highlighting BTM's superior performance in more mobile, high-risk anatomical sites.



BTM application for finger and hand defects

Discussion

This comparative study involving 50 patients revealed distinct differences in clinical outcomes based on both the type of dermal substitute used and the site of reconstruction. Patients were categorized into four groups, with BTM and MatriDerm® applied to either lower lip or hand contracture reconstructions.

BTM consistently outperformed MatriDerm® across most parameters. It demonstrated superior graft take (94% for lip and 91% for hand) compared to MatriDerm® (88% and 83%, respectively). This highlights BTM's better integration and durability, especially in dynamic areas like the lip, where tissue mobility and moisture create reconstructive challenges. Although MatriDerm® showed faster healing times (16 days for lip and 18 days for hand) due to its one-step application, this benefit was offset by higher infection rates, particularly in hand reconstructions (22%).

Aesthetic and functional outcomes followed a similar trend. BTM yielded better aesthetic scores, particularly in

lip reconstructions (8.8 vs. 7.6), as well as higher functional recovery (91% vs. 79%). This is crucial in lower lip surgeries where oral competence is essential. Patient satisfaction mirrored these results, with BTM groups reporting higher satisfaction levels (9.0 in lip vs. 8.1 in MatriDerm®).

When averaged, BTM reconstructions had a higher graft success (92.5% vs. 85.5%), better aesthetic scores (8.55 vs. 7.35), lower infection rates (8% vs. 16.5%), and greater overall functional and patient-reported outcomes. Lip reconstructions, in general, showed better results across both matrices compared to hand reconstructions, likely due to smaller wound size and better vascularity in the facial region.

According to the findings, BTM generated a greater graft take (92%) than MatriDerm® (85%). This is consistent with studies that discovered that in large burn reconstructions, BTM had a low graft failure rate and a high graft take [10,11]. BTM's exceptional performance might be attributed to its synthetic polyurethane

composition, which promotes neodermis growth before grafting and offers robust infection resistance [12].

However, MatriDerm®'s one-step treatment process likely helped it heal more quickly (17 days as opposed to 21 days for BTM). It also encourages early angiogenesis due to its collagen-elastin structure, which is derived from cows. However, its higher infection rate (20%) was in line, which showed that collagen-based matrices were relatively more prone to wound colonisation [13].

The BTM group outperformed MatriDerm® in terms of cosmetic outcomes (mean score of 8.5) based on a standardised scar assessment measure (7.4). This is in line with the research that discovered the reconstructions based on BTM exhibited more texture and pliability [14]. Additionally, the BTM group had higher patient satisfaction and functional recovery, which is crucial in dynamic areas like the lip or joints. A recent study indicated that both BTM and MatriDerm® offer unique benefits, despite the lack of comparative trials. The selection method should be customised to the reconstruction site, infection risk, and wound characteristics [15].

Generalizability

Despite the fact that this study was limited to a single tertiary care facility, the inclusion of limb and lower lip contractures offers important information about various anatomical and functional reconstruction difficulties. The results are probably applicable to comparable reconstructive surgery settings in low- and middle-income nations, especially when biological and synthetic dermal substitutes are utilized under similar postoperative care circumstances.

Conclusion

In conclusion, BTM emerged as a more reliable dermal substitute, especially for high-risk, high-mobility regions like the lip and hand. While MatriDerm®'s faster healing is advantageous, its higher infection rate and lower patient satisfaction suggest it may be better suited for select, lower-risk cases. These findings support the tailored use of dermal matrices based on anatomical site and clinical needs.

Limitations

- Small sample size (n=50) does not provide generalizable results.
- A single-center study limits the applicability to other clinical settings.
- A follow-up duration of 6 months will be insufficient to assess long-term aesthetic and functional outcomes.

- Randomization was done manually, introducing a potential selection bias.

More comprehensive multicentric randomised controlled trials with longer follow-up periods and larger sample sizes are recommended in order to validate the relative effectiveness of BTM and MatriDerm®. By combining the infection resistance of synthetic scaffolds with the regeneration properties of biological templates, hybrid matrices could further improve the results. Additionally, cost-effectiveness studies and quality-of-life assessments will be crucial for wider clinical application.

Recommendation

According to the results, BTM should be chosen for reconstructing intricate or highly mobile areas, like the hand and lip, because of its better graft take, resistance to infection, and aesthetic results. For minor, low-risk wounds where quicker healing is preferred, MatriDerm® might be suitable. To improve reconstruction procedures and bolster evidence, more multicentric randomized controlled trials with bigger sample sizes and longer follow-up are advised.

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Conflict of interest

The authors declare no conflict of interest.

Author contribution

All authors equally contributed.

Data availability

Data supporting the findings of this study are available from the corresponding author upon reasonable request.

List of abbreviations

BTM: Biodegradable Temporizing Matrix
IEC: Institutional Ethics Committee
PMCH: Patna Medical College and Hospital
SPSS: Statistical Package for the Social Sciences

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