

Case Series

Real-world case series evaluating trypsin–chymotrypsin for postoperative recovery in general surgery patients

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ABSTRACT

Postoperative inflammation plays a pivotal role in recovery, contributing to pain, oedema, and delayed wound healing, and impacting overall patient comfort. Proteolytic enzymes, particularly the oral combination of trypsin–chymotrypsin, exhibit well-documented anti-inflammatory, anti-oedematous, and fibrinolytic effects that support postoperative recovery. This retrospective case series reports real-world clinical outcomes of seven patients treated across diverse surgical conditions in India, highlighting the clinical utility of this enzyme therapy. Across all cases, adjunctive trypsin–chymotrypsin was associated with marked reductions in erythema, oedema, induration, tenderness, and pain severity, alongside improved wound healing and patient comfort during follow-up. Notably, these benefits were observed across major abdominal procedures, recurrent hernia repair, fasciotomy for cellulitis, axillary soft-tissue excision, and complex oral cavity reconstruction with flap coverage, reflecting its versatility in managing postoperative inflammation. These observations suggest that trypsin–chymotrypsin may have a favourable effect on reducing postoperative inflammatory signs and improving patient comfort across the varied surgical scenarios.

Keywords: Trypsin-chymotrypsin, Proteolytic enzymes, Postoperative inflammation, Surgical recovery, Wound healing, Oedema control

INTRODUCTION

Inflammation is a complex physiological response of the immune system to harmful stimuli that can be triggered by a variety of factors, including pathogens, damaged cells and toxic compounds. Inflammation as a defense mechanism, plays a pivotal role in maintaining tissue integrity and overall health. While inflammation serves a

protective role, dysregulated or prolonged inflammatory responses can contribute to postoperative pain, oedema, and delayed functional recovery, which may indirectly affect a patient's overall well-being in the postoperative period.¹⁻⁵ Clinical manifestations such as pain, swelling, reduced mobility, and delayed recovery are common consequences of unresolved inflammation following accidental injuries or surgical interventions.^{1,2,4,5} Tissue

repair following surgical intervention is a critical determinant of patient recovery and clinical outcomes. In surgical patients, excessive inflammation is associated with increased postoperative pain, stiffness, oedema, risk of infection, and impaired wound healing, all of which can delay recovery, prolong hospitalization, increase morbidity and overall well-being.^{1,5-8} Physiological anti-inflammatory responses aim to mitigate inflammation, alleviate pain, and promote tissue healing. Proteolytic enzyme combinations such as oral trypsin–chymotrypsin have been reported in clinical studies to reduce postoperative oedema, pain, and inflammatory signs, which may support local recovery; existing clinical evidence describes these benefits at the symptomatic level, while mechanistic explanations remain based primarily on proposed pathways in the literature.^{1,4,6,9,10} They have long been recognized for their role in modulating inflammation and facilitating tissue regeneration.⁵

Trypsin-chymotrypsin are proteolytic enzymes widely used in surgical recovery. This combination exerts anti-inflammatory, anti-oedematous, fibrinolytic, and analgesic effects by modulating cytokine activity, degrading inflammatory mediators, and improving microcirculation at the site of injury.^{1,3,4,5,7,10} Additionally, they facilitate the resolution of fibrinous exudates, reduce oxidative stress, and accelerate wound healing.^{1,5,10} Trypsin–chymotrypsin has emerged as a promising anti-inflammatory agent in general surgery, demonstrating comparative efficacy to other available enzyme therapies like trypsin: bromelain: rutoside and serratiopeptidase combinations.^{3,5}

Recent clinical trials and systematic reviews have demonstrated that oral proteolytic enzyme combinations like trypsin-chymotrypsin significantly reduce postoperative pain and oedema, enhance wound healing, and improve patient comfort in surgical patients.^{6,8-10} These benefits are associated with reduced dependence on nonsteroidal anti-inflammatory drugs (NSAIDs) and improved health-related quality of life (HRQoL) during recovery.^{6,8,9} These properties make it a valuable adjunct in surgical recovery, especially in soft tissue injuries, burns, and post-operative wound management.^{3,5}

In this context, the present case series aimed to document the postoperative anti-inflammatory effects of oral trypsin–chymotrypsin across diverse general surgical scenarios in routine clinical practice, providing real-world descriptive evidence that complements existing controlled trials.

Study design

This retrospective case series analysed real-world clinical data collected between 1 January 2025 and 30 September 2025 from practicing surgeons across multiple centres in India. Surgeons were invited to submit detailed case reports using a standardized Case report form (CRF). The

CRF included patient demographics, surgical details, postoperative findings, and clinical outcomes.

All submitted case reports were reviewed for completeness and relevance. Cases were included based on predefined criteria, primarily the use of oral trypsin–chymotrypsin (100,000 Armour units in a 1:1 ratio) for pre-/postoperative pain and inflammation management, along with the availability of clinical outcomes and supporting documentation. As this was an observational real-world case series, there was no predefined treatment protocol, and surgeons determined dose frequency and duration (typically three times daily for 14-30 days) of oral trypsin–chymotrypsin (100,000 Armour units in a 1:1 ratio). No formal statistical analysis was performed given the descriptive nature of the study. Patient confidentiality was ensured by de-identifying all personal health information. Written informed consent was obtained from all patients for the use of anonymized clinical data and images.

Patients who were not prescribed trypsin–chymotrypsin were excluded from the analysis. A total of seven cases fulfilled the inclusion criteria.

Study endpoints

The primary outcome of this case series was the reduction of postoperative inflammation, assessed clinically using a qualitative 4-point grading scale (absent, mild, moderate, severe) for erythema, oedema, induration, local irritation and tenderness, as documented in the case-report forms. Pain severity was assessed using the Visual analogue scale (VAS, 0-10). These assessments were performed by the treating surgeons as part of routine postoperative evaluation. The secondary outcomes included wound-healing progression, resolution of wound discharge, improvement in patient-reported comfort, and the absence of postoperative complications across the seven cases.

CASE SERIES

Case 1: recurrent inguinal hernia following previous bilateral hernioplasty

A 45-year-old male patient with no known comorbidities presented with a history of a large swelling in left inguinal region persisting for the past 15 years. He had previously undergone bilateral open hernioplasty 20 years ago for inguinal hernia repair, after which he remained asymptomatic until the gradual development of the current swelling. Local examination showed a soft, non-tender abdomen. A large, non-reducible left inguinal swelling measuring approximately 25×20 cm was noted, extending up to the base of the scrotum (Table 1). No cough impulse was present. A decubitus ulcer measuring 3×4 cm was observed at the base of the scrotum, which appeared dried up. He was diagnosed with recurrent inguinal hernia after bilateral hernioplasty. The patient

underwent progressive pneumoperitoneum followed by left inguinal hernioplasty with scrotoplasty under general anaesthesia.

Postoperatively, the patient was prescribed trypsin-chymotrypsin tablet (100,000 armour units) three times a day for 14 days, along with antibiotics, analgesics, and antacids. Progressive improvement was observed in erythema, oedema, induration, irritation, and tenderness, as well as pain severity from day zero to day seven follow-up (Table 1 and Figure 1).



Figure 1 (A and B): Case 1: post-operative reduction in inflammatory markers of a large left inguinal hernia wound from day 0 to day 7.

Case 2: inguinal hernia in a patient with retroviral disease and comorbidities

A 69-year-old male patient presented with complaint of a swelling in right inguinal region. He was a known case of Retroviral disease (RVD) for the past 10 years and had associated comorbidities, including diabetes mellitus for five years and hypertension for four years. On general examination, the patient was conscious and well-oriented to time, place, and person.

Local examination demonstrated a soft, non-tender abdomen. A right inguinoscrotal swelling measuring approximately 5×4 cm was noted, globular in shape and extending up to the root of the scrotum (Table 1). The swelling was reducible, with a distinct cough impulse. Testis and spermatic cord were separately palpable, confirming the integrity of the cord structures.

He was diagnosed with inguinal hernia and underwent open right inguinal hernioplasty under spinal anaesthesia. Postoperative management included tablet trypsin-chymotrypsin (100,000 armour units) three times a day for 14 days, along with a regimen of antibiotics, analgesics, and antacids.

Progressive resolution was seen in erythema, oedema, induration, tenderness and reduction in pain severity from day zero to day seven follow-up (Table 1 and Figure 2).



Figure 2 (A and B): Case 2: post-operative reduction in inflammatory markers of a right inguinal hernia wound from day 0 to day 7.

Case 3: penetrating knife injury

A 47-year-old male patient presented with a history of assault resulting in a knife injury to the medial aspect of the left thigh. He had undergone left-sided inguinal hernioplasty four months back. On general examination, the patient was conscious and oriented to time, place, and person. Local examination demonstrated a contused lacerated wound on the medial aspect of the left thigh, approximately 10-15 cm below the groin crease. The wound measured 8×4 cm and was actively oozing, with blood clots present within the ulcerated area (Table 1). Surrounding tissue showed swelling and tenderness, but no underlying fracture was detected. Neurovascular status of the limb was intact.



Figure 3 (A and B): Case 3: post-operative reduction in inflammatory markers of penetrating knife injury from day 0 to day 7.

The patient underwent thorough wound irrigation, clot removal, and meticulous layer-by-layer closure under aseptic precautions. Postoperative he was prescribed tablet trypsin-chymotrypsin (100,000 armour units) three times a day for 14 days, along with a regimen of antibiotics, analgesics, and antacids. Marked improvement observed in erythema, oedema, induration, irritation, and tenderness, along with significant reduction in pain severity from day zero to day seven follow-up (Table 1 and Figure 3).

Case 4: mucormycosis with fungal ball in transverse mesocolon

A 25-year-old male patient with no known comorbidities presented with abdominal swelling for past one month (Figure 4). He had sustained blast injury to the abdomen three months ago and had undergone laparotomy surgery in Somalia.

On local examination, a 6×5 cm non-tender swelling was noted around the umbilicus. The patient underwent laparotomy, transverse colectomy, and end-to-end colocolic anastomosis under general anaesthesia. Postoperatively, tablet trypsin-chymotrypsin (1,00,000 armour units) 3 times a day, was prescribed for one month.

Histopathological examination of the excised tissue specimen demonstrated broad, non-septate hyphae exhibiting angioinvasion, extensive coagulative necrosis, and fungal ball formation, with fungal elements distinctly highlighted by PAS (Periodic Acid-Schiff) and GMS (Grocott Methenamine Silver) staining.

These findings confirmed the diagnosis of mucormycosis involving the transverse mesocolon. At follow-up visit swelling had subsided and patient reported no discomfort.

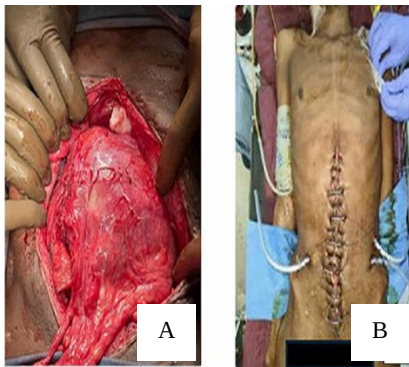


Figure 4: Case 4: abdominal swelling showing: (A) intraoperative findings and (B) postoperative wound closure.

Case 5: axillary fat pad

A 26-year-old female patient with no known comorbidities presented with swelling in the right axilla for six months. On local examination, a non-tender swelling measuring 4×3 cm was noted in the right axilla. A clinical working diagnosis of axillary fat pad was done.

The patient underwent wide local excision of the right axillary fat pad under general anaesthesia (Figure 5). Postoperatively, the patient was prescribed tablet trypsin-chymotrypsin (100,000 armour units) three times a day for two weeks, which resulted in reduced swelling, faster resolution of inflammation, and improved scar appearance, leading to better cosmetic outcomes.

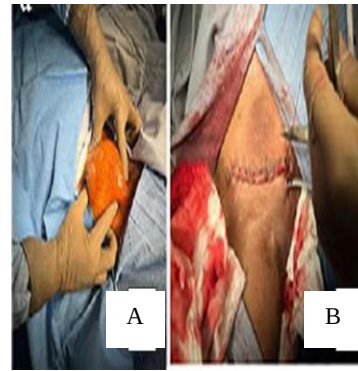


Figure 5: Case 5: axillary fat pad removal surgery showing: (A) intraoperative findings and (B) postoperative wound closure.

Case 6: left lower-limb cellulitis

A 77-year-old male patient with known hypertension and diabetes mellitus, with a history of coronary artery bypass graft (CABG), presented with painful swelling of the left lower leg for a week with VAS of one. On local examination, the swelling was red, tender, tense with rise in temperature. Clinical diagnosis of left lower leg cellulitis was made. The patient underwent fasciotomy and debridement of the left lower leg (Figure 6). Postoperatively, the patient was prescribed tablet trypsin-chymotrypsin (100,000 AU) three times a day for one month along with antibiotics, which led to significant reduction in pain and oedema, faster subsidence of inflammation, and improved wound healing.

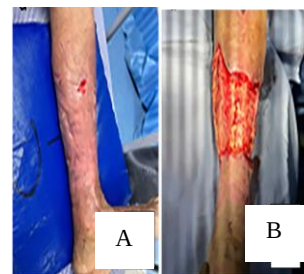


Figure 6: Case 6: left lower limb cellulitis showing: (A) initial presentation and (B) fasciotomy with debridement surgery.

Case 7: ulceroproliferative lesion of oral cavity

A 49-year-old female patient with chronic kidney disease (CKD) presented with a painful intraoral ulcer for two months, with pain radiating to the right ear. She was diagnosed with carcinoma of lower lip and had wide local excision (WLE)+ reconstruction using Abbe Estlander flap one and half year ago.

On local examination, a 4×3 cm ulceroproliferative lesion was noted at the right lower gingivobuccal sulcus, extending anteriorly to the first premolar and posteriorly to the third molar (Table 1). The retromolar trigone was

free, with no trismus or ankyloglossia. There was no involvement of the mandible, floor of the mouth, the upper gingivobuccal sulcus and facial skin. The patient underwent right comprehensive resection (wide local excision+segmental mandibulectomy+right comprehensive neck dissection (Level I–V)+pectoralis major myocutaneous flap reconstruction (PMMC) under general anaesthesia.

Postoperatively, patient was prescribed trypsin-chymotrypsin (100,000 armour units) thrice daily for 15 days along with antibiotics for three days. On follow-up visits marked reduction in tenderness, oedema, erythema, induration and local irritation was observed (Table 1 and Figure 7).



Figure 7 (A and B): Case 7: ulceroproliferative lesion of the oral cavity showing postoperative appearance on day 0 and day 7.

Table 1: Summarizes general examination findings, local examination findings and postoperative parameters from day 0 to day 7.

Parameters	Subcategory/day	Case 1	Case 2	Case 3	Case 7
General examination findings					
Pulse rate	–	82/min	88/min	78/min	88/min
Blood pressure	–	110/84 mm Hg	116/80 mm Hg	120/82 mm Hg	110/70 mm Hg
SPO ₂	–	99% on room air	99% on room air	99% on room air	Not available
RBS	–	125 mg/dl	134 mg/dl	100 mg/dl	Not available
CVS	–	Normal heart sounds (S1,S2)	Normal heart sounds (S1,S2)	Normal heart sounds (S1,S2)	Not available
Local examination findings					
Site	–	Left inguinal region	Right inguinal region	Left thigh–medial aspect	Right lower gingivobuccal sulcus
Size	–	25×20 cm	5×4 cm	8×4 cm	4×3 cm
Postoperative clinical parameters					
Erythema	Day 0	Severe	Mild	Moderate	Absent
	Day 3	Mild	Absent	Absent	Absent
	Day 7	Absent	Absent	Absent	Absent
Oedema	Day 0	Severe	Severe	Severe	Moderate
	Day 3	Moderate	Absent	Mild	Mild
	Day 7	Mild	Absent	Absent	Absent
Wound discharge	Day 0	Absent	Absent	–	Absent
	Day 3	Absent	Mild	Absent	Absent
	Day 7	Absent	Absent	Absent	Absent
Induration	Day 0	Moderate	Severe	Severe	Mild
	Day 3	Severe	Moderate	Moderate	Absent
	Day 7	Mild	Absent	Absent	Absent
Local irritation	Day 0	Mild	Absent	Mild	Mild
	Day 3	Absent	Absent	Moderate	Absent
	Day 7	Absent	Absent	Absent	Absent
Tenderness	Day 0	Severe	Moderate	Severe	Moderate
	Day 3	Mild	Mild	Moderate	Mild
	Day 7	Absent	Absent	Absent	Absent
Pain severity (VAS)	Day 0	9(VAS) (severe)	4 (VAS) (moderate)	9 (VAS) (severe)	2 (VAS) (mild)
	Day 3	4(VAS)	2 (VAS) (mild)	4 (VAS)	1 (VAS) (mild)

Continued.

Parameters	Subcategory/ day	Case 1	Case 2	Case 3	Case 7
		(moderate)		(moderate)	
	Day 7	1(VAS) (mild)	0(VAS) (no pain)	1 (VAS) (mild)	0 (VAS) (no pain)

RBS:Random blood sugar; CVS:Cardiovascular system; SPO₂:Peripheral oxygen saturation; VAS:Visual analogue score.

DISCUSSION

These real-world cases highlight the therapeutic potential of trypsin-chymotrypsin in reducing postoperative inflammation, as evidenced by decreased erythema, oedema, pain, and wound discharge, thereby facilitating faster recovery and early hospital discharge. The cases

presented in this series ranging from left inguinal hernioplasty with scrotoplasty, major abdominal surgery for mucormycosis to oral cavity cancer resection, axillary fat pad excision, and fasciotomy for cellulitis illustrates the practical benefits of trypsin-chymotrypsin in diverse surgical interventions (Table 2).

Table 2: Summary of cases.

Case	Age (yrs)	Sex	Comorbidities/ previous history	Diagnosis	Surgery performed	Trypsin-chymotrypsin in duration	Final outcome
1	45	M	None	Recurrent inguinal hernia	Progressive pneumoperitoneum+ left inguinal hernioplasty with scrotoplasty	14 days	Marked reduction in erythema, oedema, tenderness and pain; improved healing
2	69	M	Retroviral disease, hypertension, diabetes mellitus	Inguinal hernia	Open right inguinal hernioplasty	14 days	Resolution of inflammation and pain; good postoperative recovery
3	47	M	None	Penetrating knife injury	Wound irrigation+ clot removal+ meticulous layer-by-layer closure under aseptic precautions	14 days	Significant reduction in inflammation; improved wound healing
4	25	M	None	Mucormycosis-fungal ball in transverse mesocolon	Laparotomy+ transverse colectomy +end-to-end colocolic anastomosis	1 month	Swelling subsided; patient asymptomatic at follow-up
5	26	F	None	Axillary fat pad	Wide local excision of right axillary fat pad	15 days	Faster inflammatory resolution; improved scar and better cosmetic outcome
6	77	M	Hypertension, diabetes mellitus, S/P CABG	Left lower limb cellulitis	Fasciotomy+ debridement of left lower limb	1 month	Significant reduction in pain and oedema; improved wound healing
7	49	F	Chronic kidney disease (6 months)	Ulceroproliferative lesion of oral cavity	Wide local excision+ segmental mandibulectomy+ right CND+PMMC flap reconstruction	15 days	Marked reduction in oedema, tenderness and irritation; improved comfort and wound healing

CABG:Coronary artery bypass graft; CND:Comprehensive neck dissection; PMMC:Pectoralis major myocutaneous flap reconstruction; M:Male; F:Female.

Several clinical studies have demonstrated the efficacy of oral proteolytic enzymes in reducing postoperative oedema, erythema and pain.^{3,4,10,11} Similar results were

observed in first three cases in the series which showed significant reduction in erythema, oedema, induration, irritation, and pain post-surgery. Compared to other

enzyme therapies like trypsin, bromelain, rutoside and serratiopeptidase, trypsin-chymotrypsin has consistently shown favourable efficacy and tolerability across diverse surgical indications.^{10,12,13} Similarly, Singh GT, et al observed that trypsin-chymotrypsin exhibited faster resolution of swelling and improved mouth opening compared to controls in complex oral surgeries.¹⁴ These findings underscore this enzyme combination's role in modulating inflammation, contributing to faster patient recovery and reducing length of hospitalization.

Kondreddy et al reported that patients receiving trypsin-chymotrypsin after surgery had significantly lower rates of seroma and hematoma formation compared to controls, along with reduced analgesic requirements.¹⁰ Similarly, a systematic review by Gandhewar T et al found that systemic proteolytic enzyme therapy reduced postoperative oedema and pain scores significantly, highlighting its role in complex surgical cases.^{4,10,12} The fourth case involved a young male patient undergoing extensive abdominal surgery for mucormycosis. Postoperative inflammation and oedema in such cases can be profound, increasing the risk of complications like seroma and delayed healing.^{3,4,10} Trypsin-chymotrypsin therapy for one month demonstrated accelerated wound healing (rapidly reducing wound, oedema, pain, swelling) and minimal postoperative complications. Several clinical studies have demonstrated that administering trypsin-chymotrypsin for seven to 15 days postoperatively significantly accelerates the resolution of inflammation, reduces oedema and pain, and promotes faster recovery from acute tissue injury.^{3,4,10}

Minor soft tissue surgeries, such as axillary fat pad excision, often aim for optimal cosmetic outcomes and minimal discomfort. Postoperative swelling in the axilla can impair mobility and cause patient dissatisfaction.^{3,4,10} Kondreddy et al highlighted that the use of trypsin-chymotrypsin resulted in significant reduction of postoperative oedema, seroma and haematoma formation and reduction in pain and incidence of surgical site infection, better cosmetic appearance of the scar and decline in need for secondary suturing.¹⁰ In the fifth case, trypsin-chymotrypsin for two weeks led to rapid healing and improved scar outcomes. This outcome mirrors literature evidence, reinforcing its utility even in relatively simple procedures.

Cellulitis involving deep subcutaneous tissue requires aggressive surgical intervention approach in critical instances to release the pressure and prevent complications.¹⁵ Postoperative oedema and pain can delay rehabilitation and increase infection risk. Proteolytic enzymes have shown benefits in trauma and orthopedic surgeries by reducing swelling and improving joint mobility.¹³ For the sixth case in this series, trypsin-chymotrypsin was prescribed for one month, contributing to improved wound healing and reduced local inflammation. Literature supports this approach, with studies indicating that trypsin-chymotrypsin therapy

demonstrates efficacy in expediting postoperative recovery through rapid resolution of oedema, pain, and inflammatory markers.³⁻⁵ Chymotrypsin facilitates improved uptake and penetration of antibiotics by promoting the tissue-fluid interchange.¹⁶

Maxillofacial surgeries are associated with significant postoperative oedema, trismus, and pain, which can compromise oral function and aesthetics. Trypsin-chymotrypsin has been extensively studied in this context. Menon et al reported superior outcomes in facial swelling and pain control with trypsin-chymotrypsin compared to placebo in maxillofacial trauma patients.¹¹ Findings across multiple clinical trials demonstrate that the postoperative use of trypsin-chymotrypsin in surgical patients is associated with a favourable safety and tolerability profile.⁴ In the seventh case discussed in this series, the patient underwent wide local excision with segmental mandibulectomy and neck dissection, a procedure associated with high inflammatory burden.

Trypsin-chymotrypsin for 15 days resulted in significant oedema control and improved patient comfort without any side effects, consistent with published evidence. Our case series findings align with this evidence. Patients who received trypsin-chymotrypsin postoperatively demonstrated reduced local inflammation and faster wound healing across diverse surgical contexts, including abdominal, maxillofacial, and soft tissue procedures. The duration of trypsin-chymotrypsin therapy varied based on surgical complexity from 15 days in oral surgery to one month in major abdominal and fasciotomy cases reflecting individualized clinical judgment. These findings reinforce the use of trypsin-chymotrypsin in hastening surgical recovery across diverse indications. Overall, trypsin-chymotrypsin represents a safe and effective adjunct in postoperative care. Its ability to reduce erythema, oedema, and pain while accelerating healing makes it particularly valuable in surgeries associated with high inflammatory burden. However, few limitations need to be acknowledged when interpreting these observations. This case series includes a small sample size (n=7) and lacks a comparator arm, which limits generalizability and reduces the strength of causal inference. The descriptive nature of the design precludes statistical testing, and clinical heterogeneity stemming from differences in surgical procedures and treatment durations that may have influenced individual outcomes. These constraints underscore the need for larger, controlled studies to substantiate and expand upon the trends observed in this series.

CONCLUSION

In summary, this real-world case series documents postoperative changes in erythema, oedema, tenderness, and pain severity (as measured by the VAS) in patients who received oral trypsin-chymotrypsin as part of routine surgical care. These observations reflect symptomatic trends noted in practice but do not allow for

causal inference. The findings are descriptive and hypothesis-generating, and larger controlled studies are required to determine whether the enzyme combination contributes to postoperative recovery or patient outcomes in a measurable clinical parameter.

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