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EXPLORING THE WOUND-HEALING EFFICACY OF TILAKALKADI LEPA: A COMPREHENSIVE CASE STUDY

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ABSTRACT
A wound is the disruption of tissue continuity caused by physical, chemical, thermal, microbial, or immunological damage. Wound healing, a key aspect of clinical surgery, aims to restore tissue integrity. Factors such as wound site, contamination, vascular insufficiency, malnutrition, diseases like diabetes, immune deficiencies, and medications can affect healing.[1] In Ayurveda, Sushrutacharya has quotted sixty procedures (Shasti Upakrama) for the management of various ulcers. kalka (Application of paste) is one among the Shasti Upakrama.[2] In this case study, a 62year old male patients, presented with a large ulcer measuring7x9cm over dorsum of the Left foot with tendons exposed, pus discharge, foul smelling and also inflicted with maggots. Maggots were removed manually and with turpentine oil, followed by ulcer debridement. Daily dressing with *Tilakalkadi Lepa* (containing *Tilakalka*, *Jatyadi Ghrita*, *Madhu*, and *Arjuna Churna*) and sterile bandaging was performed, along with internal medications like *Triphala Guggulu*, *Gandhaka Vati*, and *Varunadi Kashaya*. The wound fully healed with scarring by day 130. Tila Kalka is effective in wound healing by reducing pain, discharge, and tenderness.

KEYPOINTS: Tilakalkadi lepa, Dustavrana, Shastiupkrama, vranopachara, Non healing ulcer.

INTRODUCTION
Since the dawn of humanity, trauma has been one of the earliest ailments faced, with the treatment of wounds becoming a priority requiring surgical intervention. Constant exposure to trauma has made humans vulnerable to injuries, and the response of tissues to these injuries has laid the foundation for all surgical practices.

The management of wounds has been a significant focus from ancient texts like the Vedas to modern medical practices. Despite advancements in surgery, wound management continues to be a complex issue. In Ayurveda, particularly in the writings of Sushruta, various types of wounds and their management are outlined, forming a crucial part of surgical knowledge. Wounds are referred to as vrana in Ayurveda, and if not treated properly, they can progress to dusht vrana, which heal slowly with scarring or may even require amputation.

Sushruta Samhita contains systematic records on wound management, with Acharya Sushruta detailing 60 therapeutic measures for treating vrana. Among these, kashaya, varti, kalka, sarpi, taila, rasakriya, and avachurnana are used for cleansing and healing wounds. Kalka treatments, in particular, have specific applications in managing wounds, possessing both cleansing and healing properties. For certain non-purulent wounds with delayed healing, tila kalka mixed with honey is recommended, given its effectiveness in promoting healing.

In Ayurvedic terms, vrana is defined as a disruption of the lining membrane, leaving a scar, aligning closely with contemporary definitions of wounds. Inflammation is viewed as an early phase of wound healing, termed vranashotha. Wounds can be classified as endogenous, arising from functional imbalances in Vata, Pitta, and Kapha, or exogenous, resulting from trauma, such as puncture, cut, laceration, or abrasion.[3]

According to Sushruta Samhita, wound management follows 60 therapeutic steps, beginning with aseptic dressing and culminating in the rehabilitation of normal structure and function. These measures aim not only to expedite healing but also to preserve the quality and aesthetics of the healing process. Classical Ayurvedic texts such as Charaka Samhita, Sushruta Samhita, Ashtanga Hridaya, Dhanwantari Nighantu, Bhavaprakash Nighantu, and Ayurveda Siksha indicate that approximately 70% of Ayurvedic wound-healing

agents are derived from plants, with 20% from minerals and 10% from animal products.

These herbal remedies are effective against various conditions including wounds, sinuses, maggots in wounds, abscesses, and more. Scientific studies have explored the wound-healing properties of many Ayurvedic plants, which enhance natural repair mechanisms. Herbal medicines play a vital role in wound management by providing disinfection, debridement, and a moist environment conducive to healing. Thus, this study aims to evaluate the therapeutic efficacy of tila kalkadi lepa as local applications in wound management.

Patient Information

Chief complaints

Patient presented with non-healing ulcer on the dorsum of the Left foot for the past 2 years, associated with pus discharge, exposed tendons, foul odor, maggots, and severe pain with a burning sensation. These symptoms have worsened over the past week.

History of Present illness

A 62-year-old patient, known case of hypertension for the past 10 years, with no known history of diabetes, was apparently normal two years ago. Once he had shoe bite, which turned into small ulcer, later got infected and developed cellulitis of the foot. He was treated with antibiotics and debridement at the ulcer site. He was advised skin graft over the ulcer got granulation tissue. But patient neglected the advise and end up in severly infected ulcer. And then the patient approached Shalya OPD at GAMC Banglore for treatment, presented with a large ulcer measuring7x9cm over dorsum of the Left foot with tendons exposed, pus discharge ,foul smelling and also inflicted with maggots.

Past History

K/C/O Hypertension since 10yrs under medication (tab Telma-com OD A/F)
N/K/C/O DM

Personal History

The patient has mixed dietary habits with a good appetite, but experiences disturbed sleep. He urinates 5 to 6 times during the day and once at night, and has regular bowel movements, passing stool once per day. There is a history of chronic smoking for the past 30 years.

Medical History

Tab Telma-com OD 1-0-0 After food.

Surgical History

Debridement of wound.

Family History

Nothing significant.

Local Examination

ON INSPECTION

NUMBER	01
SIZE	9x7x1CM
POSITION	Dorsum of left foot
EDGE	Slopping
FLOOR	1.Tendon of extensor hallucis longus and tendons of extensor digitorum longus were visible 2.Slough was present
DISCHARGE	Foul smelling pus Discharge
SHAPE	Irregular
SURROUNDING AREA	Blackish Discoloration of skin
MARGIN	Well defined and Regular

ON PALPATION

TENDERNESS	Present around the wound and over floor of wound
EDGE AND MARGIN	Tenderness present
BASE	fixed
DEPTH	1cm
BLEEDING	absent
SURROUNDING SKIN	Induration ,tenderness present Dorsalis pedis artery-not possible to elicit Anterior tibial artery-palpable Posterior tibial artery-palpable

GENERAL EXAMINATION

Pallor, Icterus, Cyanosis, Clubbing, Lymphadenopathy and edema are absent

Patient's vitals
Blood Pressure-130/90mmhg
Pulse Rate-82bpm

Respiratory Rate-19cpm

P/A-Soft, Non tender, No organomegaly

SYSTEMIC EXAMINATION
CNS- Conscious and well oriented to time, place, person. HMF intact
CVS-S1, S2 Heard, no added sounds
RESPIRATORY SYSTEM- B/L Air entry present. NVBS heard, No murmur

LYMPHNODE EXAMINATION
No Lymphadenopathy.

EXAMINATION OF NERVE LESION
NAD.

INVESTIGATION

RBC	$4.58x10^6$/uL	HIV	Nonreactive
ESR	30mm/hr	HBSAG	Negative
RBS	173mg/dl	HB	14.5g/dl
BT	2' 45"	WBC	4700
CT	4' 15"	PLT	$285x10^3$/uL

METHEDOLOGY

DAY	**INTERNAL MEDICATION**	**DOSAGE**
1^{ST} DAY	Triphala guggulu	2-2-2 (A/F)
	Gandhaka Vati	1-0-1(A/F)
	Krimikuthara Rasa	1-0-1(A/F)
	Varunadi Kashaya	15ml-0-15ml(B/F)
	LSSR	1-1-1(B/F)
	THERAPEUTIC PROCEDURE	1.Vrana Prakshalana with Terpentine oil f/b 2to 3 maggots removal 2. Vrana Prakshalana with Gomutra Arka, Panchavalkala Kashaya, Betadine Solution 3.Jathyadi Taila pichu

2^{ND} DAY TO 7^{TH} DAY	INTERNAL MEDICATION	DOSAGE
	Triphala guggulu	2-2-2 (A/F)
	Gandhaka Vati	1-0-1(A/F)
	Krimikuthara Rasa	1-0-1(A/F)
	Varunadi Kashaya	15ml-0-15ml(B/F)
	LSSR	1-1-1(B/F)
	THERAPEUTIC PROCEDURE	1.Vrana Prakshalana with Terpentine oil for 3days 2. Vrana Prakshalana with Gomutra Arka,Panchavalkala Kashaya, Betadine Solution and hydrogen peroxide 3.Jathyadi Taila pichu

8^{th} DAY TO 14^{TH} DAY	INTERNAL MEDICATION	DOSAGE
	Triphala guggulu	2-2-2 (A/F)
	Gandhaka Vati	1-0-1(A/F)
	Krimikuthara Rasa	1-0-1(A/F)
	Varunadi Kashaya	15ml-0-15ml(B/F)
	LSSR	1-1-1(B/F)
	Sahacharadi Kashaya	15ml-0-15ml(B/F)
	Triphala Churna	0-0-1tsf with warmwater(A/F)
	THERAPEUTIC PROCEDURE	1.Vrana Dhoopana with Shweta Sarshapa,Nimba patra,Guggulu for 7days 2. Vrana Prakshalana with Gomutra Arka,Panchavalkala Kashaya, Betadine Solution 3.Jathyadi Taila pichu

15TH DAY TO 30TH DAY	INTERNAL MEDICATION	DOSAGE
	Triphala guggulu	2-2-2 (A/F)
	Gandhaka Vati	1-0-1(A/F)
	Krimikuthara Rasa	1-0-1(A/F)
	Varunadi Kashaya	15ml-0-15ml(B/F)
	LSSR	1-1-1(B/F)
	Sahacharadi Kashaya	15ml-0-15ml(B/F)
	THERAPEUTIC PROCEDURE	1.Deepana, pachana with Agnitundi vati for 3days 2.Snehapana with PanchatiktagugguluGhrita for 5days inn Arohanakrama 3.vishrama kala for 3days,Sarvanga Abhyanga with Ksheerabala tailaF/b Sarvanga Sweda. 4.Virechana with Trivrut lehya 40gm with warm water Total vega 11 5.samsarjana karma for 5days 6.Vrana Prakshalana with Panchavalkala Kashaya, Betadine Solution 7.A dressing is performed using a combination of Tilakalka, Madhu, Jatyadi Ghrita, and Arjuna Churna (QS). The lepa is applied and left to dry under sunlight for 1 to 2 hours. After drying, the Tilakalka lepa is removed, and Jatyadi Ghrita Pichu is applied. Finally, a sterile dressing is done to complete the process."

31ST TO 45TH DAY	**INTERNAL MEDICATION**	**DOSAGE**
	Triphala guggulu	2-2-2 (A/F)
	Gandhaka Vati	1-0-1(A/F)
	Krimikuthara Rasa	1-0-1(A/F)
	Varunadi Kashaya	15ml-0-15ml(B/F)
	Tiktamrita cap	1-0-1(A/F)
	Sahacharadi Kashaya	15ml-0-15ml(B/F)
	THERAPEUTIC PROCEDURE	1.Vrana Prakshalana with Panchavalkala Kashaya, Betadine Solution 2.A dressing is performed using a combination of Tilakalka, Madhu, Jatyadi Ghrita, and Arjuna Churna (QS). The lepa is applied and left to dry under sunlight for 1 to 2 hours. After drying, the Tilakalka lepa is removed, and Jatyadi Ghrita Pichu is applied. Finally, a sterile dressing is done to complete the process. 3.Manjisthadi kshara basti in yogabasti pattern

46TH TO 130TH DAY	**INTERNAL MEDICATION**	**DOSAGE**
	Triphala guggulu	1-1-1(A/F)
	Patolakaturohinyadi kashaya	15-0-15(B/F)
	Agnitundi vati	1-0-1(A/F)
	Varunadi Kashaya	15ml-0-15ml(B/F)
	Tiktamrita cap	1-0-1(A/F)
	Sahacharadi Kashaya	15ml-0-15ml(B/F)
	THERAPEUTIC PROCEDURE	1.Vrana Prakshalana with Panchavalkala Kashaya, Betadine Solution 2.A dressing is performed using a combination of Tilakalka, Madhu, Jatyadi Ghrita, and Arjuna Churna (QS). The lepa is applied and left to dry under sunlight for 1 to 2 hours. After drying, the Tilakalka lepa is removed, and Jatyadi Ghrita Pichu is applied. Finally, a sterile dressing is done to complete the process.

OBSERVATION AND RESULTS

On the first day, the patient presented with a wound on the dorsum of the right foot, measuring approximately 7x9 cm. The wound had visible tendons, pus discharge, serous discharge, a foul odor, and 2–3 maggots. Initial management included cleaning the wound with turpentine oil, followed by the removal of the maggots. The wound was then cleansed with *gomutra arka*, *panchavalkala kashaya*, and betadine solution. Debridement was performed with utmost care to protect the exposed tendons, and a betadine dressing was applied.

Within 2–3 days, all maggots were removed, but slough, serous discharge, and foul odor persisted. The wound continued to be cleaned with *gomutra arka*, *panchavalkala kashaya*, and betadine solution. Dressing with *jatyadi taila pichu* was introduced, which helped reduce pain and burning sensations slightly by day 7. To address the persistent slough and odor, *vrana dhoopana* using *shweta sarshapa*, *nimba patra*, and *guggulu* was performed for seven days. This significantly reduced the foul smell and slough.

Simultaneously, internal medications were initiated. *Deepana* and *pachana* were performed using *agnitundi vati* for three days. This was followed by *snehapana* with *panchatikta guggulu ghrita* in an *arohana krama* for five days, followed by a *vishrama kala* of three days. Comprehensive body care, including *sarvanga abhyanga* with *ksheerabala taila* followed by *sarvanga sweda*, was administered. Subsequently, *virechana* was performed using 40 g of *trivrut lehya* with warm water, resulting in 11 evacuations. Post-*virechana*, a five-day *samsarjana karma* regimen was advised.

For wound management, *vrana prakshalana* was done using *panchavalkala kashaya* and betadine solution. A lepa made of *tilakalka*, *madhu*, *jatyadi ghrita*, and *arjuna churna* was applied and left to dry under sunlight for 1–2 hours. After drying, the lepa was removed, and *jatyadi ghrita pichu* was applied, followed by sterile dressing. Although initial soakage and serous discharge increased, significant muscle growth and reduced wound depth were observed. By day 50, tendons were no longer visible, and healthy granulation tissue was present alongside minimal slough and serous discharge.

The treatment was continued with *panchavalkala avagaha* (soaking) for 15 minutes, followed by dressing with *tilakalkadi lepa* and *jatyadi ghrita*. Additionally, *manjishtadi kshara basti* was performed in a *yoga basti* pattern. By day 100, there was no slough, soakage, or foul odor. The wound had reduced to 2x2 cm, with significant pain and burning relief.

By day 130, the wound had completely healed with scarring. Throughout the treatment, internal medications, dietary recommendations (*pathya* and *apathya*), and foot care were advised to support healing.

DISCUSSION ON DRUGS

TILA[4]

Tila possesses **Kashaya (astringent)** and **Tikta (bitter)** tastes. It demonstrates **Lekhana** (scraping) and **Chedana** (cutting) properties, making it effective for wound management. The anti-inflammatory and analgesic properties of Tila, attributed to sesame oil and sesamin, help alleviate wound pain (**Vrana Vedana**). Its antioxidant properties, also due to sesame, minimize oxidative damage, while its antimicrobial actions reduce excessive wound discharge (**Vrana Srava**) and unpleasant odor (**Vrana Gandha**). Tila promotes wound healing through **Vrana Shodhana** (cleansing) and **Ropana** (healing).

Tila is a plant with immense potential in wound treatment and tissue regeneration through various mechanisms. These phytomedicines are cost-effective, easily accessible, and safe. Indigenous to India and extensively cultivated in warmer regions, Tila is an erect, pubescent annual plant growing 30 cm to 1 meter tall. The seeds and the fixed oil expressed from them are primarily used, with the black seed variety being the most medicinally potent.

Properties of Tila

1. **Guna** (Qualities):
   - Guru (heavy), Snigdha (unctuous), Vyavayi (spreading), Brimhana (nourishing), Sukshma (subtle), Prinana (nurturing), Vrishya (aphrodisiac), Tvakaprasadana (improves skin texture), Medhya (enhances intellect).
2. **Rasa** (Taste): Madhura (sweet), with Anurasa (secondary taste) of Kashaya (astringent) and Tikta (bitter).
3. **Virya** (Potency): Ushna (hot).
4. **Vipaka** (Post-digestive taste): Katu (pungent).

Therapeutic Uses of Tila

Tila is **Agneya** (stimulating digestive fire), **Ushna** (hot), **Tikshna** (sharp), and exhibits properties such as **Madhura rasa**, **Madhura vipaka**, **Bruhana**, **Prinana**, **Vyavayi**, **Sukshma**, **Vishada**, **Vikasi**, **Twak-prasarak** (skin beautifier), **Medhya vardhak** (enhances intellect), **Mardavkar** (softens tissues), **Mamsa vardhak** (promotes muscle growth), **Stanyakar** (lactogenic), and **Vranahitkar** (beneficial for wounds).

MADHU[5]

Madhu (Honey) is widely used both as an Anupana (a carrier to enhance the activity of medications) and for its intrinsic medicinal properties, either alone or in combination with other drugs. It is utilized both systemically and locally for therapeutic purposes. Madhu is credited with several beneficial properties, including Lekhana (scraping), Sandhana (union), Shodhana (purification), Ropana (healing), and Tridoshaghna (pacifying all three Doshas).

Applications in Wound Healing

Madhu is often applied externally on wounds (Vrana) either alone or combined with Sarpi (Goghrita, clarified butter from cow's milk). It has a low pH (3.2–4.5) and hygroscopic nature, which prevent bacterial colonization and growth. Its low water activity (aw of 0.6) inhibits microbial proliferation, while its antibacterial properties are enhanced by hydrogen peroxide and high osmotic pressure. These qualities make Madhu particularly effective in wound management.

According to the Sushruta Samhita, Madhu plays a crucial role in Vrana management, aligning with the principles of the sixty Upakramas (therapeutic measures). It pacifies the three Doshas—Vata, Pitta, and Kapha—through its multifaceted actions.

- **Madhura (sweet) Rasa**: Nourishes tissues, aiding in granulation tissue formation.
- **Kashaya (astringent) Anurasa:** Promotes Lekhana (scraping), assisting in debridement and preparing the wound for healing.
- **Ruksha (dry) Guna:** Facilitates wound cleansing and pacifies Kapha.
- **Sheeta (cold) Virya:** Calms Pitta Dosha.
- **Madhura Vipaka** and **Sukshma Marganusari Prabhava**: Enhance tissue regeneration by penetrating microchannels.

Mechanism of Action

1. **Wound Cleansing and Healing:** Madhu exhibits Shodhana (cleansing) and Ropana (healing) effects. It aids in phagocytosis, detoxification, and proteolysis, promoting wound cleaning and tissue repair.
2. **Antibacterial and Antimicrobial Properties:** The antibacterial activity is attributed to hydrogen peroxide, while compounds like pinocembrin, terpenes, benzyl alcohol, and 3,5-dimethoxy-4-hydroxybenzoic acid contribute to its antimicrobial effects. These properties reduce wound discharge (Vrana Srava) and unpleasant odor (Vrana Gandha).
3. **Antioxidant Action:** Honey's antioxidant properties, due to the enzyme catalase, help mitigate oxidative stress and damage, further aiding in wound healing.
4. **Hyperosmolar Medium:** Its high viscosity creates a physical barrier, while its osmotic properties prevent bacterial growth and promote a conducive environment for healing.

Additional Benefits

Madhu has been found to.

- Prevent hypertrophic scarring and post-burn contractures.
- Be effective in dressing split-thickness skin grafts, resulting in minimal scarring.
- Exhibit a Rasayana (rejuvenating) effect.
- Provide a cost-effective, safe, and easy-to-implement treatment modality with no adverse effects observed during usage.

Properties of Madhu

1. **Doshaghnata:** Pacifies Vata, increases Kapha, and aggravates Pitta.
2. **Rasa:** Madhura (sweet) with Kashaya Anurasa (astringent undertone).
3. **Guna:** Ruksha (dry), Laghu (light).
4. **Actions on Vrana:**
   - **Lekhana:** Scrapes impurities.
   - **Shodhana**: Cleanses the wound.
   - **Ropana:** Promotes healing.
   - **Krimighna:** Destroys microbes.

Thus, Madhu proves to be a highly effective and versatile agent for wound management, ensuring optimal healing through its combined antibacterial, antioxidant, and wound-healing properties.

ARJUNA[6]

Major. Chemical constituents-

T. arjuna- arachidic stearate, cerasidin, arjunic acid, tannins, arjunone,, arjunetin, arjunolone, arjunglucosides I & II; arjunoside I, II & IV; arjunolic acid etc.

T. alata- gum, arjunic & arjunolic acids, arjunetin, betulinic and ellagic acids; tannins etc.

Properties

Rasa- Kaşāya
Vīrya- Śīta
Karma- Kapha-pittahara, Udardapraśamana, Hrdya
Guna- Rūkşa, Laghu
Vipāka- Kaṭu
Indications- Bhagna, Sadya Vrana (as haemostatic?), Prameha, Medoroga, Hrdroga, Kşaya, Trşnă etc.

JATHYADYA GHRITA[7]

जातीनिष्णपटोलपत्रकटुका दार्वी निशा शारिवामक्षिष्ठाभयसिक्यतुत्वमधुकैर्मक्ताह्ववीगैः सबैः । सभिः सिद्धमनेनसूक्ष्मवेदनाममर्श्रिताः स्राविणोगम्भीराः सरुजीद्व्रणाः सगतिकाः शुष्यन्तिरोहन्तिच। ।५३।।

(Cakradatt)

Ingredients: Jāti, nimba, patola (leaves), katuka, dāru haridra, haridra, sarivä, manjisthā, kustha, siktā, tuttha, madhuka, naktähva (seed), mürechita cow ghritam and water.

Process of Drug-Making: Take equal parts of jäti, nimba, patola (leaf), kajuku, dāru haridra, haridrä, särivä, manjişthä, kustha, siktā, tuttha, madhuka and naktākva (seed). Prepare a kalka out of these materials. Thus raise 250 ml. of the kulka. Cook it along with mürechita cow ghritam measuring one litre and water measuring four litres.

Method of use/Administration: The medicated phritam thus obtained should be used in ointmenting the wound.

Therapeutic benefits: Application of this mediated ghritam cleanses and heals ulcers which are deep seated, painful as well as spreading

Discussion on the Effects on Vrana

- **Effect on Vrana Vedana (Pain and Tenderness):** Pain and tenderness completely subsided by the end of the treatment. Notable reduction in pain was observed as early as the second week, which can be attributed to the local application of lukewarm Panchavalkala Kashaya Prakshalana.
- **Effect on Vrana Varna (Wound Color):** Initially, the wound color was yellowish-green. By the end of four weeks, it transformed into a healthy pink color. The slough diminished completely, and the wound floor became covered with healing granulation tissue. This change is attributed to the Shodhana (cleansing) property of the formulation.
- **Effect on Vrana Srava (Wound Discharge):** At the beginning of the treatment, there was profuse discharge. By the end of 90 days, the discharge was entirely absent. This improvement can be credited to the Shodhana effect of Tila-Kalka Lepa.
- **Effect on Vrana Gandha (Wound Odor):** The unpleasant foul odor present at the start of treatment was fully eliminated within one month. This improvement is likely due to the Shodhana properties of the formulation and the Vrana Dhoopana procedure.
- **Effect on Vrana Akriti (Wound Shape):** The wound initially had an irregular shape (Visham Akriti) with approximate dimensions of 7 cm × 9 cm. As the treatment progressed, the shape regularized, and the wound eventually healed completely, leaving minimal scarring. This healing effect is due to the Vrana Shodhana (cleansing) and Ropana (healing) properties of Tila-Kalka Lepa.

CONCLUSION

- The wound pain was effectively reduced due to the Madhura Rasa of the formulation.
- Discharge significantly decreased due to the Tikta Anurasa and Ruksha Guna.
- Tenderness reduced owing to the Ushna Veerya of the ingredients.
- The wound's color improved because of its Twakprasadan (skin rejuvenation) properties.
- Odor diminished due to Kledahara (moisture-drying) properties, attributed to Kashaya Rasa, Tikta Anurasa, and Ruksha Guna.
- Wound margins closed due to the Kashaya Rasa and Vranropaka (wound-healing) effects.
- Floor size reduced significantly due to the Vranashodhaka (wound-cleansing) property.

Overall, the local application of Tila-Kalka and Madhu,arjuna churna,jatyadi ghrita exhibited no major side effects, demonstrating its therapeutic efficacy and safety throughout the study.

1st DAY

ON 7TH DAY

Application of Tiladi kalka
45th Day

21st Day
75th Day

a11

95TH Day

110th Day

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