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# Krishna Prosthetic Limb - A Solution for Disabled Amputee Animals

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## ABSTRACT

Accidents and amputations have been a big issue both in humans and animals. Large number of animals in India suffer from road accidents and other traumatic injuries which causes fracture of long bones of fore and hind limbs. Limitations in care and management leads to simple fracture converting into compound fracture and reach a stage of amputation. *Krishna Prosthetic Limb* is an innovative approach to empower amputee animals with comfortable mobility and retain productivity of elite animals by enhancing their life span. Homopolymer of Polypropylene thermoplastic substance of varied densities as per the weight of the animal is used in monolimb design of animal prosthetic limb; the limb structure is fabricated from a single piece of thermoplastic material. It is low cost, highly effective and useful in transrediusulna, transmetacarpal and transmetatarsal amputee animals to help them walk, run, move, sit and stand comfortably.

**Keywords:** Disabled Bovine, Amputee, Prosthetic Limb, Monolimb, Polypropylene

## INTRODUCTION

As compared to human prostheses less attention has been given to animal prosthesis. The value of life, emotions and cost are key factors that have been barriers in uses of prosthetic devices in veterinary science [1]. Large number of animals in India suffer from road accidents, household injuries and other traumatic events which cause clinical harm to long bones especially fore and hind limbs [2]. Due to several challenges and limitations in animal care and management, many contaminated compounds fracture reach to a state of amputation leaving the animal permanently crippled. To save the life of an animal, amputation of limb is done [3].

*Krishna Prosthetic limb* has been designed with specific target to support suffering animals. This artificial limb is low cost, easy to use and easy to replace also with the growth of the animal who starts using it. In a work span of six years (2014-2019) total 100 *Krishna Prosthetic Limbs* have been fitted in bovines, equines and canines at various locations in 13 states of country including Rajasthan state. These animals are able to walk on their own with the support of prosthetic limbs after physiotherapy sessions. They became self-dependent and are able to lead a better and dignified life.

## MATERIALS & METHODS

Material and process used in the formation of prosthesis is crucial aspect of finding real solution to restricted mobility of amputated animal. Material for prosthetic use is durable, low cost, easy to fabricate and have weight bearing capacity up to 300 kg of animal body weight. Several low-cost materials are used to make a prosthetic limb which includes PVC pipe, high density polyethylene pipe, homo polymer of polypropylene sheets, 90/10 combination or co–polymer of polyethylene-polypropylene sheets. We found homopolymer polypropylene better suited for current use **(Table 1)**.

Thickness of material also plays an important role in prosthetic formation. We use a range of thickness between 3 mm to 8 mm and vary the same as per the body weight. Less weight thickness is used in yearling, debilitated calf having body weight up to 25-40 kg, while higher one is appropriate for adult and heavy animals having body weight between up to 300 kg.

Before the decision of material and thickness of material, doing the amputation surgery is very crucial. If amputation is not done as prescribed, the chances of fitting and success of prosthesis becomes bleak. Surgical procedure needs to be done keeping prosthesis possibility in consideration. In case of lower limb prosthesis, amputation should be done from the site of fracture rather than from joint capsule [4].

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Maximum part of long bone must be preserved for anchoring the prosthesis. The amputation of limb is carried out as per standard surgical procedure. A minimum of 8 to 10-inch length from the proximal end of the long bone must remain intact for optimal fitting of prosthesis.

**Table 1.** Physical Properties of PVC, HDPE, PP Materials.

| S. No. | Properties | Polyvinylchloride (PVC) | High density Polyethylene (HDPE) | Homopolymer Polypropylene (PP) |
|---|---|---|---|---|
| 1 | Minimum Temperature | 13°F/25°C | 148°F/100°C | 32°F/0°C |
| 2 | Maximum Temperature | 158°F/70°C | 248°F/120°C | 275°F/136°C |
| 3 | Autoclavable | No | No | Yes |
| 4 | Melting Point | 176°F/80°C | 266°F/130°C | 338°F/170°C |
| 5 | Tensile Strength | 6500 psi | 4550 psi | 4500 psi |
| 6 | Hardness | R 105 | SD 65 | R 95 |
| 7 | Specific Gravity | 1.34 | 0.95 | 0.90 |

**Parts of *Krishna Prosthetic Limb***

*Krishna Prosthetic Limb* is a monolimb design, which is useful in transredioulna, transmetacarpal and transmetatarsal. Below and above carpal joint and below hock joint prosthetic components include socket, shank and belt. Socket serves as interface between the residual limb and the prosthesis while protecting the residual limb and proportionately shifting the body force while standing and ambulating. Socket liner is soft leather or foam sheet to prevent skin abrasions, reducing bone pressure on prosthesis and improving socket suspension. Shank attaches the socket and provide axial rotation to absorb, store and release energy. Belt is used to tie and support the limb to the amputee limb [5,6].

There are four main processes followed in the making of prosthetic: Casting, standing alignment, alignment transfer and monolimb fabrication. The alignment process is very crucial as it allows the animal to attain correct posture and support from the device. Measurement of stump anteriorly and posteriorly is first step. A mould is made using plaster of paris bandage by measuring length of the normal limb. Then appropriate material is picked and melted in hot air oven as per the table specifications above. It is then stretched over the mould, allowed to cool at room temperature. It is then finally tied to the animal on amputated limb using a belt.

Complications may occur while using prosthetic limb in animals, which limits its use if cautions are not observed **(Table 2)**.

**Table 2.** Possible complications and causes.

| S. No | Complications | Possible Causes |
|---|---|---|
| 1 | Tearing of prosthetic limb due to weight | Improper selection of material strength with respect to its weight bearing capacity. |
| 2 | Injuries on soft tissue/muscles/tendons of amputee limb | Improper distribution of body weight on pressure sensitive parts |
| 3 | Socket design is too loose or too tight to fit | Improper formation of socket |
| 4 | Continuous pain on applied part | Improper surgical amputation or neuroma |
| 5 | Leading to skin abrasions, skin/muscle wound, erythema | Overuse of prosthetic limb, improper fitting, improper liner |
| 6 | Carpal/Hock joint flexion contracture | Contracture of 10 degree or less requiring conservative treatment of stretching technique |
| 7 | Carpal/Hock joint flexion contracture | Contracture of 25 degree or more requiring lengthening of carpal joint by surgical technique |

| | | |
|---|---|---|
| 8 | Lost interest psychologically to stand and walk on foot | Phantom sensation syndrome (heaviness feel in amputee part) |
| 9 | Proximal part of socket fits too tight on residual limb, venous congestion | Choke syndrome/venous stasis |
| 10 | Reluctance in accepting prosthetic limb | Lack of or improper physiotherapy or exercises or aggressive behavior of animal |
| 12 | Reluctance in adapting or mobility with prosthetic limb | Animal tied in stagnant position for a long time or limited walk on hard surface |

## RESULTS & DISCUSSION

A number of animals in India undergo amputations every year due to various traumas including roadside accidents, traumatic hits by blunt object, landmine tragedies at border areas etc., but we do not have an authentic data of amputee animals. After these tragic instances (depending on injury) injured animal is unable to move freely on his limbs, always struggle in search of food and water and depend on the attendant. Work capacity and productive value of animal decreases rendering the animal unstable also. The most feasible solution to this problem is to fit the amputees with prosthetic devices to counteract their disability and restricted mobility. Artificial limb technologies are not easily accessible to people in lower income segments because of the high cost associated with production and customization of artificial limbs prosthetics. There are few designs being popularly used in a few countries catering to wildlife animals, but these incur huge cost because of being technology intensive. They are also hard to be reproduced because of sophisticated mechanical assistance and processes which limit their use for low income segments and make it difficult to replicate also. Krishna limb fitted in bovines, canines an equine and has proved its efficacy and sustainability after field testing on 100 cases. It would be equally be usable for all category of animals with similar efficiency and comfort. Quantitative assessment of gait including both kinetic (force plate) and kinematic assessment would be more useful but in case of poor animal owners and orphan cows kept in Gaushalas sophisticated costly instruments have limited use [7].

## REFERENCES

1. Orsini JA, Warner A, Dyson S, Nuamaker D (1985) Lower extremity amputation and application of a prosthetic device in a 1-month-old calf. Vet Surg 14(4): 307-309.
2. Mobility India (2007).
3. Stills, COM (1976) Vacuum-Formed Orthoses for Fracture of The Tibia. Orthot Prosthet 30(2): 43-55.
4. Sethi PK, Udawat MP, Kasliwal SC, Chandra RS (1978) Vulcanizes rubber foot for lower limb amputees. Prosthet Orthot Int 2(3): 125-136.
5. Sisson S (1953) The Anatomy of Domestic Animals. W.B.Saunders Co, pp: 125-156.
6. Jit S, Tyagi RPS, Sukhbir S (2020) Application of prosthetic limb in ruminants; Ruminant Surgery. CBS Publishers &Distributors Pvt. Ltd, pp: 527-532.
7. Kumar JA (2015) Biodegradablity and Waste Management of Jaipur Foot. Pharma Tutor (2): 41-46.