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# D-cleft: An innovative method for feeding neonates born with cleft palate

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## Abstract

**Introduction:** Babies born with cleft palate suffer from feeding problems which interfere with their nutrition and development; thereby, hampering the criteria for subsequent corrective surgery. The palatal cleft interferes with nursing and causes insufficient suckling or nasal regurgitation of food. Because of altered anatomy and presence of oro-nasal fistula, baby tends to present suction difficulties due to lack of negative intraoral pressure. Upper respiratory tract infection and chronic catarrh are not frequent. **Materials and Methods:** Here is a patented device for attaching on commercially-available feeding bottles to facilitate effective nutrition method. The device's journey from concept to clinical use has been presented with a case series. **Results:** The device was tried and tested successfully in many babies born with Cleft palate. It has been successfully used to feeding neonates by their mothers/care-takers with almost no training required. **Conclusion:** The device is extremely easy to use, easy to maintain and economical. In cases where modifying the feeding position alone cannot make much difference, these attachments can be advocated.

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## Full Text

## Introduction

Babies born with cleft palate anomaly suffer from feeding problems which interfere with their nutrition for growth and development; thereby, hampering the criteria for subsequent corrective surgery. The palatal cleft interferes with nursing and causes insufficient suckling or aspiration/nasal regurgitation of food. Coughing, choking, vomiting, infection of the nasopharynx, and chronic catarrh are frequent.

Because of altered anatomy and presence of oronasal fistula, baby tends to present suction difficulties due to lack of negative intraoral pressure. The nursing time is longer. This can lead to anxiety and concern of parents and/or caregivers. [1] The immediate problem to be addressed in a newborn with cleft lip/palate is the interference of feeding.[2]

Presented here is an innovative solution, a patented device for attaching on commercially available feeding bottles to facilitate effective nutrition method. The presentation is not only case series report but also about this device's journey from concept to patient. It is to show that any invention with right amount of care grows into a fruitful tree benefitting masses.

## Materials and Methods

Innovation is the backbone for providing solutions. Any innovative idea has to follow a series of steps to convert into viable effective solution. These steps include idea, patent, prototype, trials, and mass manufacture.

The journey of the present idea started with attachment of commonly available plastic spoons to the rim area of feeding bottle cap. This provided a seal on cleft palate defect during feeding procedure. It also provided a scaffold against which the nipple could rest on and be pressurized on during suckling motions. Further, it could be customized by addition of soft relining material to seal the defect completely while stabilizing the attachment.

In a series of otherwise successful case trials, main drawbacks found were improper fit of spoon to the plastic of bottle and greater distance between concave surface of spoon to the nipple during suckling movement.

Further development of the device was entrusted to a team of professionals at who tirelessly worked on the design. The device was hence further modified to fit to the rim of bottle around the whole circumference and adapted by wax in proximity to the nipple for better suckling without need for greater pressure.

This was followed by filing of patent which included complete specification and all possible modifications of device. Several iterations later, final three dimensional (3D) design of the device was formed. D-cleft was thus printed in 3D printing machines using polyvinyl alcohol material in Flashforge 3D machine. Prototypes were finished using waterproof sandpaper abrasives. The prototypes are currently being tried on patients for final modifications before the next steps of mold formation for mass production [Figure 1].{Figure 1}

## Results

The device was tried and tested successfully in many neonates born with cleft palate. It has been successfully used to feeding neonates by their mothers/caretakers with almost no training required.

D-cleft provided a good seal of palatal defect from nasal regurgitation and was found to act as a scaffold against pressing of feeding bottle's nipple during suckling movements. It has overcome several disadvantages presented by indwelling tubes or long-term intraoral attachment methods most importantly constant irritability for child. Other drawbacks such as impression procedure, sterilization, and hygiene issues are almost nonexistent.

## Discussion

Previous literature mentions several methods of feeding for babies born with cleft palate. Some of the most common citations and their drawbacks are as follows.

Large clefts in the lip and palate are common congenital anomalies. If the cleft palate is large enough, conventional feeding techniques may not provide proper nutrition for the infant. Feeding obturators will aid in the ability of the infant to attain suction and help the infant feed adequately.[3]

Reid reviewed and stated that feeding treatment modalities should be preceded by altering the positioning of the baby. In PRS babies with cleft palate, breastfeeding is not possible, but one can always attempt it. In all feeding practices, baby should be kept in an upright position, with head in one hand and bottle in another, and fed at an angle of 45° with frequent burping of the child. This allows the milk to flow down and helps prevent choking. If incorrect position is employed for feeding, milk may enter the respiratory passage.[4]

Devi et al. discussed different feeding methods mentioned in various literatures and suggested that breast, bottle, spoon, or cup feeding or a combination may be chosen with lactation instructions pertaining to correct positioning of the child. Specialty feeding products such as supplement nursing system or special feeding bottles such as Mead Johnson, Haberman Feeder, and soft squeeze baby bottle. However, these special products have drawbacks such as high-cost, leakage around the nipple, and difficulty in sterilization.[5]

Prodoehl and Shattuck stated that as a feeding modality, the placement of an indwelling nasogastric tube should be considered in case upper airway obstruction and feeding difficulties are not resolved by prone positioning. The use of feeding tubes is said to be responsible for most of the recorded perforations as they are soft at first and become hard and stiff after several hours of use. Reports of rare complications such as urinary bladder perforation, pericardial sac perforation, and enterobacteriaceae colonization on prolonged feeding expose the risks associated with using intubation for feeding.[6]

According to Savion and Huband, there are two schools of thoughts. The first one advocates its advantages as ease in feeding, facilitation of cleft repair, enhancement of speech, and facial growth. The other group claims its disadvantages such as cumbersome impression taking procedure, difficulties associated with sterilization and hygiene maintenance, expensive manufacture, and effort involved in training the caretaker about effective intraoral attachment of prosthesis.[7]

In this article, we present to you an innovative solution; a device for attaching on commercially available feeding bottles to facilitate effective nutrition method. The presentation is not only case series report but also about this device's journey from concept to patient.

## Conclusion

Very few clinicians have knowledge of fabricating prosthesis for feeding such patients which otherwise adds to the distress of caretakers. The presented device is extremely easy to use, easy to maintain, and highly economical. In cases where modifying the feeding position alone cannot make much difference, these attachments can be advocated.

It is a versatile device in that it can be attached to feeding bottle of any measurement and it can be brought to fit the cleft defect without any hassle. Further scope of using face scanner, table top scanner, and 3D printing machines to customize such feeding prostheses is also possible.

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Conflicts of interest

There are no conflicts of interest.

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