

## Ultrasound Analysis of Sucking Behavior of Newborn Infants : Sucking Pressure of Newborn Infants with Cleft Palate during Nutritive Sucking

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### ABSTRACT

Sucking behavior was studied with ultrasound during nutritive sucking in four full-term neonates with cleft palate and lip but without neurologic or other abnormalities. Sucking pressure was measured simultaneously and displayed with ultrasonograms. The peristaltic tongue movements of these infants were the same as those of normal neonates, but sucking pressure was not generated. These findings indicate that neonates with cleft palate cannot generate sucking pressure during nutritive sucking. (Jikeikai Med J 2002 ; 49 : 47-9)

Key words : suking pressure, cleft palate, ultrasonography

### INTRODUCTION

We have previously reported that the generation of sucking pressure in neonates is closely related to sequential changes caused by the peristaltic movement of the tongue in the volume of the space formed by the posterior portion of the tongue, the palate, and nipple<sup>1</sup>. To clarify the relationship between sucking pressure and volume of the space and to clarify the driving force behind sucking pressure, in the present study we examined the sucking behavior of neonates with cleft palate who could not form a space with the tongue, palate, and nipple because of the absence of the palate.

### SUBJECT AND METHODS

Sucking behavior was studied with ultrasound 6 days after birth in 4 neonates (3 boys and 1 girl) with cleft palate and cleft lip. Mean gestational age was

38.3 weeks, and mean birth weight was 2,914 g (range, 2,694 to 3,113 g). All newborns had been delivered transvaginally and had Apgar score of at 8 at 1 minute. They were fed breast milk and formula from bottles with ordinary nipples. Examination revealed no neurological or physical abnormalities except for cleft lip and palate. Real-time ultrasound examination were performed in the sagittal plane from the submental aspect with a Toshiba SSA-250A apparatus with mechanical sector scanner and a 5-MHz sector probe. A special device to directly measure sucking pressure was attached to type K silicon rubber nipple (Pigeon Corp., Tokyo). The pressure sensor was placed near the hole of the nipple and connected to a transducer with silicon rubber tube that was not flattened during sucking. The transducer was connected to the ultrasound apparatus via an amplifier, and sequential changes in the pattern of sucking pressure were displayed with real-time ultrasound images (Fig. 1).

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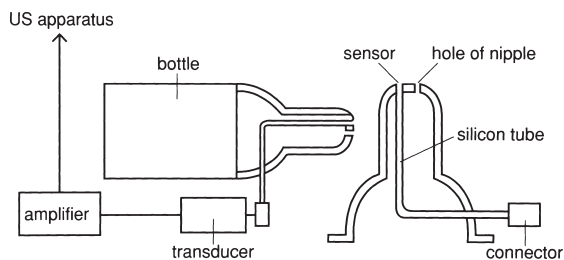


Fig. 1. Schematic diagram of a device for directly measuring sucking pressure.

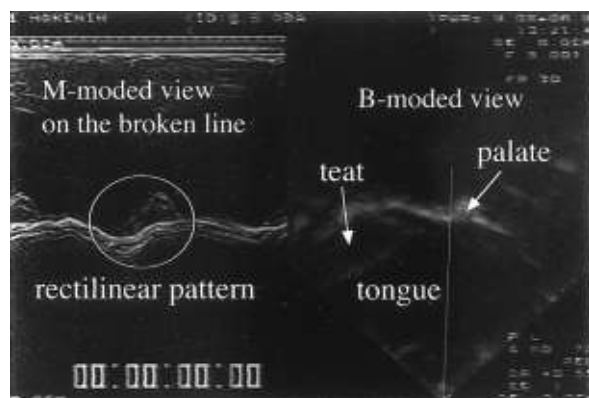


Fig. 2. B-mode and M-mode ultrasonograms of normal neonates presenting the rectilinear pattern that indicates the sequential changes in the volume of the space formed by the tongue, palate, and nipple.

This study was approved by the appropriate hospital ethics committee, and the mothers of the subjects gave their consent after having been informed of the purpose and the method of this study.

## RESULTS

The following findings were observed in each of the four subjects.

1. On B-mode ultrasound, tongue movements were the same peristaltic movements previously observed in healthy neonates. However, the rectilinear pattern in M-mode ultrasound which had indicated sequential changes in the volume of the space surrounded by the posterior portion of tongue, the palate, and nipple was not detected (Fig. 2, Fig. 3-a, and 3-b).
2. Negative pressure was not detected during sucking; therefore, sucking pressure pattern curves were always flat (Figs. 4 and 5).

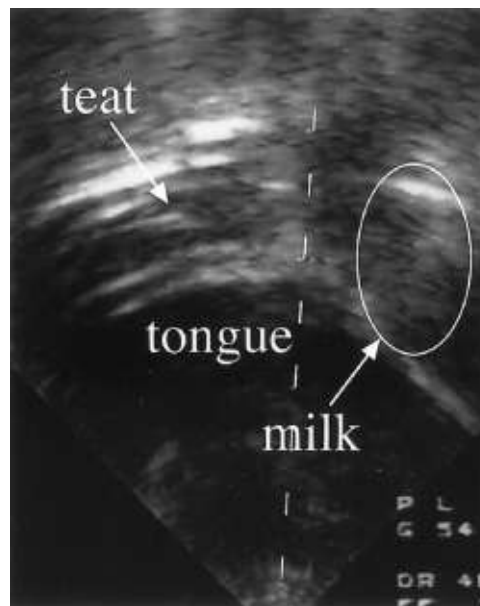


Fig. 3-a. B-mode ultrasonogram of neonates with cleft palate during nutritive sucking.

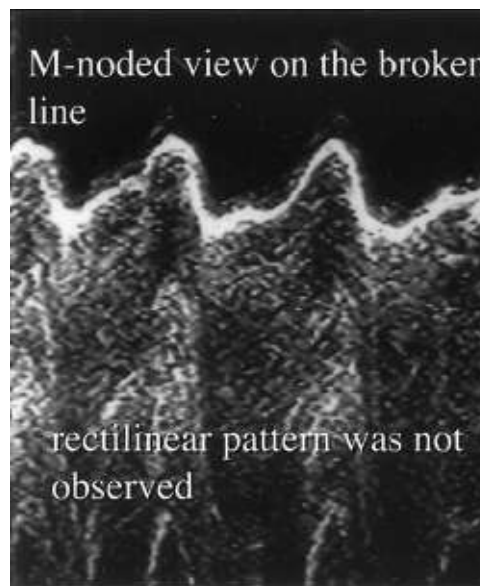


Fig. 3-b. M-mode ultrasonogram of neonates with cleft palate. The rectilinear pattern was not observed.

## DISCUSSION

During nutritive sucking by healthy neonates, the tongue repeatedly comes in contact with and separates from the palate, and the volume of the space formed by the tongue, the palate, and the nipple

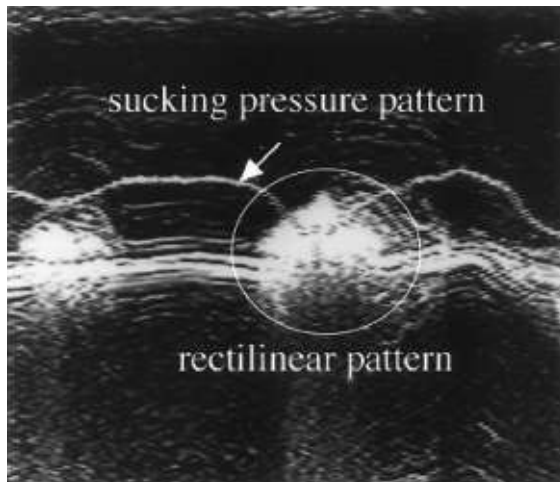


Fig. 4. The relationship between the rectilinear pattern and sucking pressure in normal neonates. Sucking pressure developed and increased shortly before the appearance of the rectilinear pattern.

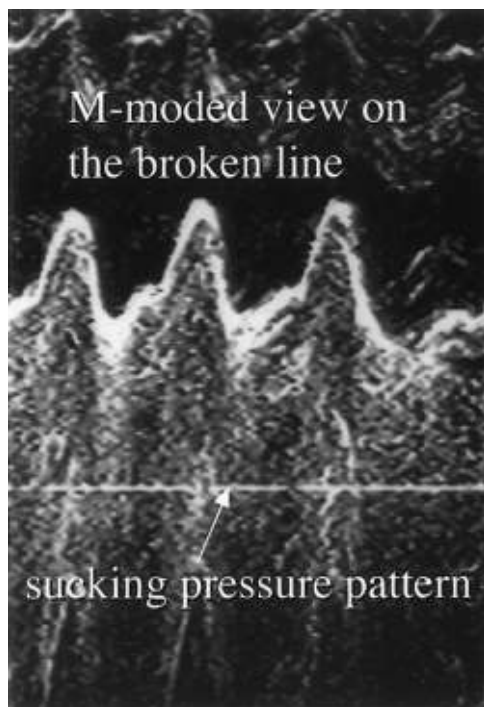


Fig. 5. Sucking pressure pattern displayed with M-mode ultrasonograms during nutritive sucking. Sucking pressure pattern curves were always flat in the four neonates with cleft palate.

changes repeatedly with peristaltic tongue movements. These sequential movements appear as rectilinear patterns on M-mode ultrasound images<sup>1-3</sup>. In healthy neonates sucking pressure develops and increases shortly before the appearance of the rectilinear pattern while the tongue is in contact with the palate; shortly thereafter, the tongue separates from the palate and sucking pressure weakens<sup>1</sup>.

In this study sucking pressure did not develop in any of the four neonates with cleft palate who could not form a space with the tongue, palate, and nipple in the oral cavity because the tongue could not come in contact with the absent palate. These findings indicate that the space formed by the tongue, palate, and nipple is required to generate sucking pressure and that the driving force of sucking pressure is sequential changes in the volume of that space. Neonates with cleft palate can take milk into the oral cavity by the pressure of the teat or nipple and ejection of breast milk without sucking pressure and can swallow milk poured into the pharyngeal space.

#### REFERENCES

1. Hayashi Y, Hoashi E, Nara T. Ultrasonographic analysis of sucking behavior of newborn infants: the driving force of sucking pressure. *Early Hum Dev* 1997; 49: 33-8
2. Eishima K. The analysis of sucking behavior in newborn infants. *Early Hum Dev* 1991; 27: 163-73.
3. Bosma JF, Hepburn LG, Josell SD, Baker K. Ultrasound demonstration of tongue motion during suckle feeding. *Dev Med Child Neurol* 1990; 32: 223-229.