

The Thai nasality test for cleft palate patients

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Background : *The evaluation of resonance disorders is an important and necessary guide for effective management of patients with palate clefting. The nasal characteristics are determined by a speech assessment. Both perceptual assessment and instrumental measurement in nasality have been recognized by clinical specialists. Although speech as standard stimulus items for assessment is required for both methods, the stimulus items are not available for Thai language. Therefore, a Thai standard nasality test for use with clinically perceptual judgements and a speech instrument is needed for Thai cleft palate patients.*

Objective : *To design a Thai language standard test to measure nasality in cleft palate patients.*

Setting : *Speech and Language Clinic, Department of Rehabilitation Medicine, King Chulalongkorn Memorial Hospital, The Thai Red Cross Society, Bangkok 10330, Thailand.*

Research design : *Descriptive statistics*

Patients / : *32 cleft palate patients who had undergone the operation at the Depart-*

Materials : *ment of Surgery, King Chulalongkorn Memorial Hospital but who never received speech therapy and 32 normal speech subjects matched in sex and age with the cleft palate group.*

Methods : *(intervention / measurement / statistics) : There were two processes :*

1. Designing the nasality test which consists of three passage types :

1. Hyponasality test "Manee" consisting of 40 nasal consonant occurrences.

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2. *Hypernasality test "Tuk Tuk" excluded all nasal consonant phonemes.*
 3. *Thai standard passage "Sai Yok Water Fall" contained of all of the Thai consonant phonemes included the clusters, and 28% occurrences of nasal consonant phonemes*
2. *Investigating the designed test both by the specialists as the perceptual assessment, and an instrument assessment using the model 6200-3 Nasometer.*

Results : *The results of the two assessments agreed well with the purpose of the nasality test. The perceptual assessment of the cleft palate patients, based on the 7-point scale of nasality, showed results of +2 and +3 that represented moderate and severe hypernasality. And the results of the test investigation showed significant differences between normal and cleft palate groups in responding to the passages "Tuk Tuk" ($p=0.02$) and the standard passage "Sai Yok Water fall" ($p = 0.05$). As expected the hyponasality test showed a non-significant difference between groups because there were no hyponasal problems in cleft palate subjects. The cleft palate patient group had higher nasalance scores than the normal subjects in all three passages. Mean nasalance scores of the normal subjects were : hyponasality test "Manee" mean = 59.36%, SD = 9.88 (range 42.83 - 77.57), Hypernasality test "Tuk Tuk" mean = 15.01 %, SD = 8.26 (range 5.6 - 37.79), passage "Sai Yok Water Fall" mean = 37.63%, SD = 7.68 (range 25.47 - 53.84). And mean nasalance scores of the cleft palate patients were :Hyponasality test "Manee" mean = 66.21%, SD = 6.74 (range 54.76 - 79.85), hypernasality test "Tuk Tuk" mean = 53.62%, SD = 9.48 (range 34.24 - 71.85), Passage "Sai Yok Water Fall" mean = 58.81%, SD = 8.46 (range 44.35 -75.21)*

Conclusions : *The Thai nasality test (THAI-NAT) can be clinically used as a standard pattern to identify nasality in cleft palate patients both by perceptual and instrumental assessment.*

Key words : *Resonance disorders, Thai nasality test, Cleft palate, Nasalance scores.*

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นันทนา ประชาฤทธิ์ภักดี, ศรีวิมล มโนเชิวพิณีจ, สิริกัญญา เลิศศรัณยพงศ์, ผ่องศรี
สุดันทวีบูลย์. แบบทดสอบเสียงนาสิกสำหรับผู้ป่วยเพดานโหว่ไทย. จุฬาลงกรณ์เวชสาร 2542
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ปัญหา : การประเมินความถี่ของเสียงพูด เป็นสิ่งสำคัญและจำเป็นสำหรับการ
วางแผนการรักษาและแก้ไขการพูดผู้ป่วยเพดานโหว่การประเมินคุณภาพของ
เสียงนาสิกสามารถแสดงถึงการทำงานของช่องบริเวณเพดานอ่อน และผนังคอได้
การประเมินเสียงผิดปกติทำได้ 2 วิธี คือ วิธีการรับฟังเสียง และการใช้เครื่องมือตรวจ
วิธีการดังกล่าวเป็นที่ยอมรับโดยนักอรรถบำบัดว่าเป็นมาตรฐานสำหรับใช้ในการ
ตรวจ แต่ปัจจุบันนี้ยังไม่มีแบบทดสอบมาตรฐานภาษาไทยใช้ คณะผู้วิจัยจึงเห็น
ความจำเป็นในการสร้างแบบทดสอบเพื่อประเมินเสียงนาสิกอย่างเป็นระบบได้
ทั้งโดยการรับฟังเสียง และใช้กับเครื่องมือวัดความถี่ของเสียงพูด

วัตถุประสงค์ : เพื่อสร้างแบบทดสอบมาตรฐานภาษาไทยสำหรับประเมินเสียงนาสิกในผู้ป่วย
เพดานโหว่

สถานที่ที่ทำการศึกษา : หน่วยอรรถบำบัด ฝ่ายเวชศาสตร์ฟื้นฟู โรงพยาบาลจุฬาลงกรณ์ สภากาชาดไทย

รูปแบบการวิจัย : การศึกษาแบบสถิติเชิงพรรณนา

วิธีการ แบ่งเป็น 2 ขั้นตอน คือ ขั้นตอนที่ 1. การสร้างแบบทดสอบซึ่งประกอบด้วย บทความ
"มานี" เป็นแบบทดสอบเสียงก้องในจมูกประกอบด้วยเสียงพยัญชนะนาสิก
จำนวน 40 เสียง บทความ "รถตุ๊กตุ๊ก" เป็นแบบทดสอบเสียงขึ้นจมูก ซึ่งไม่มีเสียง
พยัญชนะนาสิกเลย และ บทความ "น้ำตกไทรโยค" เป็นบทความมาตรฐาน ซึ่ง
ประกอบด้วยเสียงพยัญชนะทุกเสียงในภาษาไทย โดยมีเสียงพยัญชนะนาสิก 28%
ขั้นตอนที่ 2. การตรวจสอบแบบทดสอบที่สร้างขึ้น โดยใช้วิธีโสตสัทศาสตร์และ
วิธีกลศาสตร์ โดยใช้เครื่องมือ Nasometer

ประชากรที่ทำการศึกษา : ประชากรกลุ่มผู้ป่วยเพดานโหว่ที่มาใช้บริการจากคณะทำงานเพื่อรักษาผู้ป่วย
เพดานโหว่ของโรงพยาบาลจุฬาลงกรณ์ ผู้ป่วยเหล่านี้ได้รับการผ่าตัดเพดานโหว่แต่
ยังไม่เคยได้รับการฝึกและแก้ไขการพูดและกลุ่มประชากรปกติที่ไม่มีปัญหาทาง
ภาษาและการพูด โดยประชากรกลุ่มนี้ พยายามจัดสรรให้มีเพศและวัยที่ใกล้เคียง
กับประชากรกลุ่มแรกให้มากที่สุด ประชากรแต่ละกลุ่มมีจำนวน 32 ราย

ผลการศึกษา : ผลจากการตรวจสอบแบบทดสอบเสียงนาสิกที่สร้างขึ้นโดยวิธีโสตสัทศาสตร์ และ
วิธีกลศาสตร์ด้วยเครื่องมือ Nasometer มีความสอดคล้องกัน กล่าวคือด้วยวิธี
วิธีการตรวจทางโสตสัทศาสตร์ ซึ่งแบ่งความถี่ น้อยของเสียงขึ้นจมูกเป็น 7
ระดับ พบว่าผู้ป่วยมีเสียงขึ้นจมูกที่ระดับ ปานกลาง และรุนแรง (+2, +3) และพบ

ว่าแบบทดสอบเสียงขึ้นจมูก "รถตุ๊กตุ๊ก" และแบบทดสอบมาตรฐาน "น้ำตกไทรโยค" สามารถแยกทดสอบและประเมินแยกความแตกต่างระหว่างทั้งสองกลุ่มได้อย่างมีนัยสำคัญทางสถิติตามลำดับ ($p = 0.02$, $p = 0.05$) ส่วนแบบทดสอบเสียงก้องในจมูก "มานี" ไม่มีความแตกต่างกันอย่างมีนัยสำคัญตามที่คาดหมายเนื่องจากผู้ป่วยเพศานโหว่กลุ่มนี้ไม่มีปัญหาเสียงก้องในจมูกอย่างไรก็ตามผลการตรวจสอบทางกลศาสตร์ด้วยเครื่องมือพบว่าผู้ป่วยเพศานโหว่มีเสียงขึ้นจมูกมากกว่าประชากรปกติในทุกแบบทดสอบ โดยมีค่า *nasalance scores* ดังนี้ค่า *nasalance scores* ของประชากรปกติ แบบทดสอบเสียงก้องในจมูก "มานี" ค่า *mean* = 59.36 %, *SD* = 9.88 (*range* 42.83-77.57) แบบทดสอบเสียงขึ้นจมูก "รถตุ๊กตุ๊ก" ค่า *mean* = 15.01 %, *SD* = 8.26 (*range* 5.6-37.79) แบบทดสอบมาตรฐาน "น้ำตกไทรโยค" ค่า *mean* = 37.63 %, *SD* = 7.68 (*range* 25.47-53.84) ส่วนค่า *nasalance scores* ของผู้ป่วยเพศานโหว่ได้ค่าสูงกว่าดังนี้ แบบทดสอบมาตรฐานเสียงก้องในจมูก "มานี" ค่า *mean* = 66.21 %, *SD* = 6.74 (*range* 54.76-79.85) แบบทดสอบมาตรฐานเสียงขึ้นจมูก "รถตุ๊กตุ๊ก" ค่า *mean* = 53.62 %, *SD* = 9.48 (*range* 34.24-71.85) แบบทดสอบมาตรฐาน "น้ำตกไทรโยค" ค่า *mean* = 58.81 %, *SD* = 8.46 (*range* 44.35-75.21)

วิจารณ์และสรุป : แบบทดสอบเสียงนาสิกไทยซึ่งเป็นแบบทดสอบที่ถูกสร้างขึ้นโดยการคัดเลือกหน่วยเสียงพยัญชนะภาษาไทยตามหลักภาษาศาสตร์เพื่อจุดประสงค์ในการนำมาประเมินระดับความก้องที่ผิดปกติของเสียงพูดสำหรับผู้ป่วยเพศานโหว่ตามหลักทางโสตสัทศาสตร์ โดยนักอรรถบำบัด และตามหลักกลศาสตร์ โดยใช้เครื่องมือวัดความก้องของเสียง *Nasometer* การวิจัยครั้งนี้ พบว่าแบบทดสอบมาตรฐานเสียงขึ้นจมูก "รถตุ๊กตุ๊ก" และแบบทดสอบมาตรฐาน "น้ำตกไทรโยค" มีความแตกต่างกันอย่างมีนัยสำคัญ แต่เนื่องจากประชากรกลุ่มศึกษาไม่มีปัญหาเสียงก้องในจมูก จึงไม่พบความแตกต่างระหว่างกลุ่มของแบบทดสอบเสียงก้องในจมูก "มานี" การศึกษาครั้งนี้เป็นการยืนยันว่าแบบทดสอบเสียงนาสิกทั้งสามแบบนี้สามารถนำมาใช้เป็นแบบทดสอบมาตรฐานเสียงนาสิกไทยสำหรับผู้ป่วยเพศานโหว่ได้ทั้งโดยวิธีทดสอบตามหลักโสตสัทศาสตร์ และทางกลศาสตร์

Resonance disorders are generally considered the major deviations in cleft palate speech disorders. Vocal resonance in normal voices is produced by a relatively relaxed vocal tract that is only intermittently coupled to the nasal cavity for production of the nasal consonants /m/, /n/ and /ŋ/. For all other Thai speech sounds, oral rather than nasal resonance is required.^(1,2) Inappropriate nasal escape on non-nasal consonants and hypernasal resonance during speech may indicate velopharyngeal incompetence.^(3,4) Nasality may be related to both organic and functional causes that adversely affect velopharyngeal closure and consequently prevent the effective separation of the oral cavity from the nasal cavity.^(5,6) The organic cause of nasal problems results from failure of the velopharyngeal port to attain and maintain sufficient closure in preventing nasal resonance of sounds that are normally resonated orally. Meanwhile, the functional cause results from faulty learning habits. The comprehensive method of evaluation of resonance distortion, therefore, is an important and necessary guide for effective management of patients with palate clefting. In the past, speech and language pathologists have relied heavily on subjective judgements, but in recent years investigator have been looking for assessment methods for these this kind of speech disorders in cleft palate patients. The approach that specialists on cleft palate teams have recognized is the powerful clinical application of instrumentation and the value of objective data for assessing. The speech instruments are, however, designed to pick up and display only some parts of the energy forms involved in verbal communication processes. The speech stimulus items for the instrumental measurements

necessarily use tests which are firstly based upon perceptual judgement.⁽⁹⁾ The limitations of speech instrumental measurements leads to the need for speech stimulus patterns for tapping speech defects. Consequently, many tests have been developed, validated and are reliable for English speaking patients. But there are still no Thai language speech stimulus items available. Therefore, it is obvious that Thai standard passages which could serve as the stimuli for systematic instrumental and perceptual assessment are necessary.

There are several speech symptoms frequently associated with cleft palates, such as velopharyngeal dysfunction and resonance disorders (such as hypernasality, hyponasality, nasal emission and cul-de-sac resonance).⁽¹⁰⁻¹²⁾ Effective resonance assessment is of concern not only to speech-language pathologists, but surgeons and prothodontists as well. If the diagnosis is incorrect, any surgical or prosthetic attempts to manage the problem may be fruitless. Now, due to the lack of a Thai language standard nasality test, changes in vocal resonance and nasalization that follow cleft palate surgery or prosthetic management can not be anticipated. Moreover, it is difficult to interpret some of the data collected as normative data because standard contexts are unavailable. The normative data, especially on standard passages may help speech and language pathologists to determine resonance change, and thus improve assessment procedures.

Materials and Methods

The study was divided into two processes:

1. Developing the nasality test by using a linguistic approach. The test was directed to the

production of the phonetic criterion for selecting consonant phonemes that predict the nasal problem. The nasality test consists of three passages: hyponasality test "Manee", hypernasality test "Tuk Tuk" and standard passage "Sai Yok Water Fall".

2. Investigating the nasality test as to whether it could differentiate the degree of nasality deviation. The test was evaluated by both perceptual and instrumental assessments.

Appendix

- appendix A. "มานี"

มานีนั่งดื่มน้ำมะนาว
หมอยังไม่นัดวันแน่นอน
นางงามเริ่มทำงาน
เมื่อเย็นแม่มองเห็นแมวดำ
คุณมัดหมี่ล้างมือในห้องนี้

(The "Manee" consisted of 40 times of nasal consonant occurrences)

- appendix B. "รถตุ๊กตุ๊ก"

ปิติขับรถตุ๊กตุ๊กไปตลาดปากเกร็ด ซื้อปลากระบอกแปดกิโล
ซากลับเจอสารวัตรที่ปากซอย ปิติตกใจบีบแตร รถเสียหลักอัด
กับเสาไฟฟ้า สารวัตรจับปรับแก้ว้อยบาท ปิติเสียใจขับรถตุ๊กตุ๊ก
เข้าตรอกแล้วจอดใต้ตึก ปิติเจ็บใจเตะตะกร้อไปกระแทกกระจกแตก

(The "Tuk Tuk" passage excludes all nasal consonants)

- appendix C. "น้ำตกไทรโยค"

คุณพ่อคุณแม่พาฉันรอนั่งรถไฟไปเที่ยวว้่น้ำตกไทรโยคจังหวัดกาญจนบุรี ทุกคน
ตื่นเต้นมากตื่นแต่เช้า ช่วยกันจัดกระเป๋าขึ้นรถไฟสถานีรถไฟสามเสน ฉันรอนั่งริมหน้าต่าง
รถไฟ ชมทิวทัศน์ตามทางเห็นควายลุยโคลน เมื่อรถไฟแล่นข้ามสะพานแม่น้ำแควถึงสถานี
ไทรโยค ทุกคนขึ้นรถสองแถวไปที่น้ำตก ที่นั่นมีคนมากน้ำตกไหลแรงอากาศสดชื่น ตอนเที่ยง
คุณพ่อให้เงินไปซื้อข้าวเหนียว ไก่ย่าง ส้มตำ ปลาตุ๋นย่าง มานั่งกินกันตรงโพรงไม้ข้างน้ำตก
เวลาบ่ายทุกคนเตรียมตัวกลับบ้าน คุณแม่ซื้อมะพร้าว มะพร้าว หัดโคน ครองแครง พลุและ
ไม้กวาดไปฝากเพื่อน ฉันรอนั่งรถกลับบ้าน นั่งฟังประตูลับตลอดทางจนถึงกรุงเทพฯ ๙

(The "Sai Yok Water Fall contains all consonant phonemes and 28% nasal consonants)

The THAI-NAT developing was supported by the Princess Mother's Medical Volunteer Foundation.

1. Developing the reading passages

Three passages were used as stimuli in this study :

1. The first was a series of sentences, called the "Manee" that are loaded with 40 occurrences of nasal consonants. These sentences are intended to be used in the assessment of denasality and nasal airway impairment (Appendix A).

2. The second reading passage, called the "Tuk Tuk" passage, is devoid of nasal consonant phonemes and was designed to assess the degree of hypernasality (Appendix B).

3. The third passage, called the "Sai Yok Water Fall" consisted of all consonant phonemes, including the clusters, and 28 % of nasal consonant occurrences. This passage is semantically and syntactically more complex than the other two passages (Appendix C).

2. Investigation of the designed test

2.1 Perceptual assessment of nasal resonances

A clinical assessment of each patient was conducted using a standard evaluation protocol based on the Thai Nasality Test (Pracharitpakdee N, Pracharitpakdee M. 1997).⁽¹³⁾ In this way, the nasality evaluation used a 7- point equal appearing interval scale on which "0" represented normal resonance and "-3" denoted severe hyponasality and "+3" represented severe hypernasality. Nasal emission was separately evaluated and is not discussed in this study.

For the contextual nasality test, nasality was assessed by occluding and releasing the nares during the reading of the first passage "Manee" and the second "Tuk Tuk". For the third passage "Sai Yok Water Fall" the speech was assessed while the subject read naturally. The perceptual assessment

of oral-nasal resonance balance in each subject's speech was evaluated by three speech and language pathologists who each had have at least 5 years of experience on cleft palate speech therapy. As the inter-judge reliability testing was conducted, the three specialists were present when the patients were seen. Prior to testing, each subject was asked to read the three passages. Those subjects who made errors while reading the passages were asked to repeat the entire passage.

2.2 Instrumental assessment of nasal resonance

The Model 6200-3 Nasometer is a micro-computer-based instrument introduced in 1987 by Kay Elemetrics. With this device, oral and nasal components of a subject's speech are captured by microphones on either side of a sound separator plate which is held in place on the upper lip by a headgear apparatus. This configuration ensures that patients can move their heads without affecting the test results. The signal from each microphone is filtered and digitized by custom electronic modules. The data are then processed by a computer and accompanying software. A numeric ratio of nasal acoustic energy is calculated, multiplied by 100, and expressed as a "nasalance score". Therefore, the output of this instrument provides the investigator with a score that reflects the relative amount of nasal acoustic energy in a subject's speech. If nasal airway obstruction diminishes nasal resonance, nasality impaired individuals should manifest low nasalance scores when asked to produce a speech stimuli loaded with nasal consonant phonemes. Low nasalance scores also should be expected among individuals who are judged to be hyponasal because both the nasometer and the human ear presumably are sensitive to speech in

which the nasal consonants are produced with diminished nasal resonance. If nasometric measures of oral/nasal resonance balance were found to correspond fairly closely with clinical judgments of hyponasality, then the Nasometer might assist clinicians in assessing patients suspected of having denasal speech. Conversely, abnormally high nasalance scores during production of non-nasal consonant phonemes is indicative of hypernasality. High nasalance scores should also be expected among individuals who are judged to be hypernasal. And it is reasonable to assume that patients with high nasalance scores would manifest pressure-flow test results indicative of velopharyngeal impairment. Test-retest reliability was assessed using the 10 normal adult subjects speaking the complete "Manee", "Tuk Tuk" and "Sai Yok Water Fall" passages. Retests were given the day after the original test using the Nasometer. Subtle differences could occur within 4 %n of nasalance scores as a function of stimuli type. This indicates that subjects may produce slight variations of results.

The Nasometer was calibrated and the head set adjusted in accordance with the manufacturer's instructions prior to testing. And as in the same as the perceptual assessment, if the subject made errors while reading the passages they were asked to repeat the entire passage.

Subjects

All of the subjects were native Thai speakers and could read the passages and were willing to participate in this study. They were divided into 2 groups with 32 subjects each. The sample of patient subjects was composed of 18 females and 14 males

with ages ranging from 14 - 44 years (mean age 23). All subjects had prior cleft palate operations at King Chulalongkorn Memorial Hospital and had never received speech therapy. The normal subjects were matched in sex and age to the patient group. Their ages ranged 14-45 years (mean age 25). All were assessed as having normal speech characteristics with no evidence of hyper- or hyponasality. The researchers made appointments with all subjects. The assessment procedure was conducted at the Speech and Language Pathology Unit, Department of Rehabilitation Medicine, King Chulalongkorn Memorial Hospital during the period November 1998 to March 1999.

Results

The perceptual assessment results showed that the nasality ratings of the patient group were +2 and +3, representing moderate and severe hypernasality. And the normal group's were 0 indicating no nasality problems. The results with the Nasometer assessment showed high nasalance scores on the three passages because of the acoustic characteristics of the cleft palate speech. The two methods of analyzing hypernasality were found to have Pearson correlation coefficients of 0.41 in the "Manee" passage, 0.44 in the "Tuk Tuk" passage and 0.29 in "Sai Yok Water Fall" passage. As expected, significant differences were observed between the normal group and the cleft palate patient group in the "Tuk Tuk" passage ($p = 0.02$) and the "Sai Yok" Water Fall passage ($p = 0.05$). However, no significant difference of hyponasality was observed in the "Manee" passage between two groups. The mean nasalance scores of the two groups of subjects for

the three reading passages are shown in tables 1 and 2. The evidence showed that the different scores incorporated into these passages produced substantial differences in degree of nasality in the speech. The nasalance scores of the patient subjects showed the degree around the mean nasalance values more than in the normal subjects.

Discussion

It was expected that the cleft palate group would show different speech characteristics from the normal group both in resonance and nasality aspects and this would be discernable by both the perceptual assessment and the instrumental assessment. It was found that the cleft palate group had hypernasality in responding to the "Tuk Tuk" and "Sai Yok Water Fall " standard passages. There was no clear picture of resonance difference between the two groups for the "Manee" passage. The reason is that there was no hyponasality problem in these subjects, both cleft palate and normal speakers as

shown in the perceptual assessment (+2 and +3) and the instrumental assessment (nasalance scores higher than 50 %). Nasalance scores of less than 50 % on the nasal sentences are often associated with judgements of at least mild to moderate denasality.^(7,14) It appears from the "Manee" hyponasality passage test that Nasometer measurements can be used with considerable confidence in collaboration with clinical impressions of hyponasality in cleft palate speech as patients with nasal emission in their speech are very likely to obtain high nasalance scores.⁽⁷⁾ Such assessments, can detect the problem explicitly only through the graphical mode whereas a highly experienced speech and language pathologist can also differentiate nasal emissions from nasal resonance by using this passage. Therefore, the "Manee" passage can be used as a Thai language standard passage because it not only does contain the 40 occurrences of nasal consonants (5 times more than English nasal sentences), but it is also devoid of

Table 1. Means nasalance scores of normal subjects (n = 32).

Passages	Means (%)	SD.	Ranges
Manee	59.36	9.88	(42.83 - 77.57)
Tuk Tuk	15.01	8.26	(5.6 - 37.79)
Sai Yok Water Fall	37.63	7.68	(25.47 - 53.84)

Table 2. Means nasalance scores of cleft palate patients (n = 32).

Passages	Means (%)	SD.	Ranges
Manee	66.21	6.74	(54.76 - 79.85)
Tuk Tuk	53.62	9.48	(34.24 - 71.85)
Sai Yok Water Fall	58.81	8.46	(44.35 - 75.21)

pressure consonants. This is to prevent a nasal emission event while using this passage. In addition, studies in different groups of patients who tend to have hyponasality problems e.g. motor speech disorders (cerebral palsy and dysarthria), enlarged adenoids, apart syndrome and obstructed pharyngeal flap, should be investigated by using the "Manee" passage. The significant correlation between the perceptual assessment and the instrumental assessment emphasizes that either method is an efficient procedure in differential diagnosis for cleft palate speech.

A number of studies have been conducted to determine the range of nasalance scores manifested by normal speakers.^(14,15) But the nasalance scores tend to vary across languages⁽¹⁶⁾ If nasalanace scores vary as a function of language, it seems reasonable for speech and language pathologists to establish the normative nasalance data by that language against which the nasalance score of the patients can be judged, i.e. the English standard "Zoo" passage nasalance scores over 32 % and is judged to be characterized by at least mild to moderate hypernasality.⁽¹⁶⁾ Meanwhile the normal mean nasalance scores of the Thai language standard "Tuk Tuk" passage showed smaller percentages. It is possible that in the Thai language the pressure consonants more widely occur and, moreover, the Thai vowels are not nasalized, even adjacent to the nasal consonants.⁽¹⁷⁾ Based on linguistic criteria in developing the test the researchers anticipated that there would be a significant finding for implement in clinical usage. That was the test would be used to detect the differences between normal subjects

and cleft palate patients. However, it should be noted here that this study was a preliminary report in a small group of subjects. To obtain a cutoff normative nasalance score for the Thai language standard passage, a repetitive study on a large group of subjects should be conducted.

The English language standardized passages, recommended for patients to read when being evaluated with the instrument, are included in the Nasometer software and available for on-screen presentation. But such passages cannot be used with the non-English native speaker, e.g. Thai patients. This reflects that some speech and language instruments need special stimuli for individual languages. Thai standard passages are thus very necessary. Meanwhile, nasometric measures of oral/nasal resonance balance were found to correspond fairly closely with clinical judgments of nasality, thus the Nasometer might assist clinicians in assessing patients suspected of having cleft palate speech. The usage of the same stimuli can make it easier to detect the differences in nasality problems that may reflect normal structure or which may reflect degrees of deviation. And the preliminary normative nasalance values, taken together with acoustic and perceptual information could ultimately assist in predicting and differentiating measure changes for those cleft palate patients.

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