Effects of nasal aspiration by the Proetz® method in pediatric patients with sinusitis

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http://dx.doi.org/10.1590/1806-9282.66.11.1503

INTRODUCTION

Nasal obstruction is a common symptom of upper-airway disorders in children, and conservative therapy for nasal passage obstruction, whenever indicated, is essential1. However, to reestablish the drainage pathway by clearing the paranasal sinuses is as important as eliminating the etiologic agent2. Some interference of nasal cleansing and massage over nasal aeration can be observed in children with physiological mouth breathing. Nasal aeration measures showed sensitivity to the cleansing and massage techniques, and measures of nasal geometry confirmed its effect on respiratory physiology3.
In order to relieve the nasal obstruction in the upper airways, some techniques lead to good results, like the nasal instillation of saline solution, therapeutic ultrasound and nasal aspiration with Proetz. The method of nasal aspiration with Proetz was described by and named after Arthur W. Proetz in 1926. It consists of the clearing of the nasal cavity to decongest the upper airways. This technique is performed through the nostrils by means of suction that exerts negative pressure in the nasal cavities. It is based on the air elasticity principle in the paranasal cavities and the gas-compressibility law for the displacement of secretions.

It is known that PA usually causes from 6 to 8 upper airway infectious attacks a year, with high symptomatology of nasal duct obstruction. Therefore, studies on nasal aspiration with the Proetz method are justified, and if proven effective, it may open doors to the pediatric society to a new therapeutic method based on scientific evidence regarding the efficacy of the technique in the treatment of nasal obstruction.

The guiding question of this study was designed based on the PICO acronym, in which P stands for the Population (pediatric patients - PA), I for Intervention (effects of nasal aspiration with Proetz method), and CO for Context (nasal obstruction due to sinusitis diagnosis). Therefore, the following question arose: Is the Proetz method effective for the removal of secretions from the nasal duct in pediatric patients?

The aim of this study was to characterize the effects of nasal aspiration with Proetz in PNIF in PS patients with nasal obstruction.

**METHODS**

This is a non-randomized descriptive-analytical clinical trial with a quantitative approach. It was conducted at the Respiratory Physiotherapy Department, pediatric wing, from the Centro Universitário Doutor Leão Sampaio (Unileão), in Juazeiro do Norte, Brasil, in May 2017. The study was approved by the Research Ethics Committee of Unileão under nº 2256330. All the parents or guardians signed a term of consent and patients signed an assent term.

The sample comprised 30 male and female children aged between 4 and 10 years. They were selected by intentional sampling, including sinusitis patients with nasal obstruction whose guardians signed all the terms presented to them. The exclusion criteria were: children with neurologic diseases, with cognitive, renal, metabolic and/or cardiovascular alterations; those with facial trauma, headache, facial burns, recurrent epistaxis, diagnosis of neoplasia; patients in a mediate or immediate postoperative period; children who could not complete the tests presented by the researchers.

The treatment was carried out in the afternoon, in a climate-controlled environment, at the same temperature proposed in the study by Teixeira et al., namely, between 22 and 24°C. At first, the children were submitted to a clinical examination that included an ectoscopy followed by the measurement of the PNIF and evaluation using the VAS.

The PNIF was measured to analyze how much the nasal obstruction interfered with the intake of air, or if there was no direct influence. The measurement was performed by using an in-check inspiratory flow meter (Clement Clark International) with a padded oronasal mask over the face of the patient. The values of the analysis ranged from 30 to 370 L/min registered on the surface of the cylinder after each inhalation. The result was immediately obtained.

The VAS was carried out to evaluate the level of nasal obstruction according to the child’s subjective perception. The scale ranges from 0 to 10, and it is organized by colors that describe the intensity of nasal congestion, which goes from mild to moderate, to severe. This scale has already been used in other studies with good acceptance and promising results for the subjective analysis of pain in children and adolescents, like in the study conducted by Tostes et al.

It is important to point out that before the measurement of PNIF was performed, it was clearly and concisely explained to the patient, taking each age into account. The patient was placed in a sitting position, and the mask was properly adjusted to the face so that no air could escape from it. To start the procedure, the command “close your mouth and smell the flower very quickly” was given, which, in a playful way, corresponds to quickly breathing in through the nose. Three measurements were taken from each patient at intervals of 1 minute, and at the end, the highest was selected. If a variation higher than 40 L/min was detected between measurements, a new evaluation was done.

Once the measurements were taken and after a resting period, the SNOT-22 questionnaire was applied. Translated into Portuguese by Kosugi et al., this questionnaire analyzes symptoms during two weeks prior to its application. The questions were adapted so that the legal guardians could answer
them. Although it is self-applicable, the researchers were available to help the respondents, without interfering in their answers, when questions came up.

The SNOT-22 is specific for sino-nasal disorders. It is composed of 22 questions that encompass nasal, paranasal, and psychological symptoms as well as aspects related to the quality of sleep. Each question receives a score from 0 to 5, where 0 is the absence of a condition and 5 is the most severe case of the condition. The questionnaire also evaluates the quality of life of sinusitis patients; therefore, it is also applied whenever interventional processes or therapeutic procedures are to be conducted so that their efficacy and the significant effects on the life of the patient can be analyzed. SNOT-22 is considered the best questionnaire for the evaluation of sinusitis. After all the analyses were carried out, nasal aspiration with the Proetz® method was performed. The patient was in a quiet environment, lying on a stretcher with no head elevation, and the therapist was alongside the head of the stretcher for the procedure. A 10 ml syringe was used for the gradual introduction of 0.9 saline solution to thin the secretions, and then the vacuum aspiration (-150/-180mmHg) technique was applied. The same process was repeated for the second nostril. The whole procedure lasted from 2 to 4 minutes aiming to remove all the secretions from the paranasal sinuses, and the PNIF could then be reassessed. The statistical analysis was performed using the Shapiro-Wilk test for the analysis of data normality. It was observed that the variable post-inspiratory pressure did not show normal distribution (p=0.011), and the variable post-VAS had a probability value close to non-normal distribution (0.071). Hence, the descriptive values mean, standard deviation, median, and 25-75 percentiles were shown. For inferential comparison, the Wilcoxon and Spearman’s rank tests were used for the variables from the SNOT-22 questionnaire. The Stata 11 software was used for data analysis.

**RESULTS**

The sample was composed of 30 children clinically diagnosed with sinusitis. There were 16 females (53.3%) and 14 males (46.7%) at an average age of 6.4±1.8 years, ranging between 4 and 10 years (S² 3.206 and SE 0.327). The means and medians obtained from the VAS and PNIF before and after the Proetz® method are shown in Table 1. Initially, it could be observed that the VAS scores significantly improved with the Proetz® method. Before the procedure, 10 (33.30%) of the participants had a moderate score, and 20 (60.70%) had a severe score. However, after the method was used, the entire sample (n=30) presented a mild score, indicating that there was a reduction in nasal obstruction according to the patients’ perception. The analysis of the PNIF measurement showed significant improvement after the procedure. Before the application of the technique, the values ranged from 40 to 100 L/min. On the other hand, after the intervention, these values ranged from 50 to 120 L/min in all patients, with an increase of 80% in one of them.

**TABLE 1. DESCRIPTIVE VALUES AND TESTING OF HYPOTHESIS FOR THE DIFFERENCES IN THE VISUAL ANALOGICAL SCALE (VAS) AND INSPIRATORY PRESSURE BEFORE AND AFTER THE PROCEDURE.**

| Indicators          | VAS          | Inspiratory pressure |
|---------------------|--------------|----------------------|
|                     | Before (sd)  | After (sd)           | Before (p25–p75) | After (p25–p75) |
| Mean                | 7.5 (1.4)    | 2.6 (1.0)            | 64.0 (20,1)      | 79.8 (20,4)     |
| p                   | <0.001       | <0.001               | <0.001           |                |
| Median              | 7.0 (7–8)    | 2 (2–3)              | 60 (50–80)       | 80 (60–100)     |

sd = standard deviation; p25 = 25 percentile; p75 = 75 percentile; * Wilcoxon test.

Table 2 shows the Spearman correlation for VAS and PNIF before and after the Proetz® method. No statistical significance could be found in this correlation.

**TABLE 2. SPEARMAN CORRELATION BETWEEN VAS BEFORE - INSPIRATORY PRESSURE BEFORE AND VAS AFTER - INSPIRATORY PRESSURE AFTER.**

| Correlation                  | Spearman rank correlation | p        |
|------------------------------|---------------------------|----------|
| VAS before – inspiratory pressure before | 0.26                      | 0.168    |
| VAS after – inspiratory pressure after  | 0.14                      | 0.465    |

*VAS: Visual Analogical Scale

The analyses of the SNOT-22 questionnaire can be found in Table 3.

According to the data supplied by the patients, after the procedure, there was a statistical significance for the variables “need to blow nose”, “sneezing”, “runny nose”, “cough”, “post-nasal discharge”, “thick nasal discharge”, “ear fullness”, “ear pain”, “facial pain/pressure”, “difficulty to fall asleep”, “wake up at night”, “reduced concentration”, “frustrated/restless/irritable”, “sad”, “decreased sense of smell/taste” and “nasal blockage”. The results reveal that there is a direct impact on the patients’ quality of life.
DISCUSSION

Besides drug therapies and surgical approaches that target the improvement in airway clearance, there are other resources that can bring the breathing function closer to normal. Such resources consist of a clinical procedure called nasal irrigation, which allows for an improvement in bilateral air intake and output through the cleansing of the airways with 0.9% saline and non-invasive aspiration. However, the results obtained from this procedure regarding nasal permeability are usually subjectively evaluated. The quantitative measurements of peak nasal inspiratory and expiratory flow are of utmost importance.

A study conducted by Fritz showed the great efficacy of the Proetz® method in children in the treatment of paranasal sinus obstruction, especially the ethmoid sinus. Such results minimize or eliminate the complications brought by sinusitis in this population. Stancić had a sample of 166 children aged between 6 months and 14 years with upper airway obstructions who did not respond to conventional pharmacological treatment. When the Proetz® method was used, it helped in the patients’ full recovery from nasal obstruction conditions. The result obtained from the use of the Proetz® method regarding the improvement in nasal clearance and permeability increases aeration efficiency due to the clearance of the paranasal sinuses. Therefore, the effect of the method on nasal permeability, in structural terms related to the nasal mucosa, is significant, the functional effect on aeration was a fact that can be considered satisfactory for the recovery from nasal obstructive conditions. Tugrul et al. worked with a sample of 90 children suffering from acute rhinosinusitis on whom the nasal obstruction treatment was performed. There was a significance in the values of PNIF after the procedure. Soler et al. conducted a study with individuals between 2 and 21 years old diagnosed with chronic rhinosinusitis. They underwent conservative treatment for 6 months before and after the intervention. According to the results obtained from the SNOT-22 questionnaire, the patients seemed to be confident regarding their overall quality of life with mean values 42.2 ± 19.2 vs. 10.4 ± 9.7, p < 0.0001.

Ciprandi et al. studied the correlation of VAS for nasal obstruction and the PNIF. The researchers...
confirmed the relevance of the clinical use of the scale, with Spearman’s coefficient rho=0.879 (p<0.001).

Hence, the application of the method in PA with nasal obstruction is strongly recommended. After the Proetz® method, according to the VAS for nasal obstruction, patients described their pain as mild, and an improvement in nasal obstruction and in nasal aeration could be observed. The insufficient sample size, as well as the lack of comparative literature on the subject (very few similar studies using the same technique in different populations), were factors that posed as limitations to the current study.

**CONCLUSION**

It could be observed that nasal aspiration with the Proetz® method significantly improved the clinical condition of sinusitis patients with nasal obstruction according to the visual analogical scale, the PNIF, and the SNOT-22 questionnaire. No correlation between the VAS and the PNIF could be found. The study confirms the importance of the application of non-pharmacological interventions in the treatment of sinusitis in children, thus resulting in an improvement in their quality of life. Additionally, this group of researchers hopes to enrich the national literature with further knowledge on the real effects of Proetz®, a valuable tool for pediatric physiotherapy.

**Author’s Contribution**

Yaskara Amorim Filgueira: Conceptualization, Validation, Investigation, and Writing; Vanderlan Nogueira Holanda: Writing - Review & Editing; Fernando Luiz Affonso Fonseca: Investigation, Supervision, Project Management; David Feder: Investigation, Supervision, Writing - Editing, Project Management.

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**RESUMO**

**OBJETIVO:** Caracterizar os efeitos da aspiração nasal com Proetz® no pico do fluxo inspiratório nasal (PNIF) em pacientes com sinusite pediátrica (SP) com obstrução nasal.

**MÉTODOS:** Trata-se de um ensaio clínico analítico descritivo, não randomizado, com abordagem quantitativa. A amostra foi composta por 30 crianças. Inicialmente, o PNIF foi medido e a escala visual analógica (EVA) foi utilizada para obstrução nasal, seguida do procedimento de aspiração nasal. O questionário Snot-22 foi aplicado ao responsável legal de cada criança e, uma semana depois, foi reaplicado para fins de acompanhamento.

**RESULTADOS:** Dezesseis (53,3%) pacientes eram do sexo feminino e 14 (46,7%) do sexo masculino, com idade média de 6,4±1,8 anos (entre 4 e 10 anos). A análise da EVA para obstrução antes da intervenção revelou que dez dos participantes (33,3%) apresentaram níveis moderados e 20 deles (66,7%), níveis graves. No entanto, após a aplicação do método Proetz®, todas as amostras (n=30) apresentaram níveis leves. O PNIF aumentou significativamente após a utilização da técnica, com uma melhoria de 23,4% nos valores médios. Não houve correlação significativa entre EVA e PNIF.

**CONCLUSÃO:** A aspiração nasal com o método Proetz® melhorou significativamente o quadro clínico de pacientes com sinusite com obstrução nasal, de acordo com a escala visual analógica, o PNIF e o questionário Snot-22. Não foi encontrada correlação entre EVA e PNIF. O estudo confirma a importância de intervenções não farmacológicas no tratamento da sinusite em crianças, resultando em melhora na sua qualidade de vida.

**PALAVRAS-CHAVE:** Sinusite. Infeções respiratórias. Criança. Obstrução nasal.

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