[Original Research]

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Nasal vs Oronasal CPAP for OSA Treatment

A Meta-analysis

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BACKGROUND: Nasal CPAP is the "gold standard" treatment for OSA. However, oronasal masks are frequently used in clinical practice. The aim of this study was to perform a meta-analysis of all randomized and nonrandomized trials that compared nasal vs oronasal masks on CPAP level, residual apnea-hypopnea index (AHI), and CPAP adherence to treat OSA.

METHODS: The Cochrane Central Register of Controlled Trials, Medline, and Web of Science were searched for relevant studies in any language with the following terms: "sleep apnea" *and* "CPAP" *or* "sleep apnea" *and* "oronasal mask" *or* "OSA" *and* "oronasal CPAP" *or* "oronasal mask" *and* "adherence." Studies on CPAP treatment for OSA were included, based on the following criteria: (1) original article; (2) randomized or nonrandomized trials; and (3) comparison between nasal and oronasal CPAP included pressure level, and/or residual AHI, and/or CPAP adherence.

RESULTS: We identified five randomized and eight nonrandomized trials (4,563 patients) that reported CPAP level and/or residual AHI and/or CPAP adherence. Overall, the random-effects meta-analysis revealed that as compared with nasal, oronasal masks were associated with a significantly higher CPAP level (Hedges' g, –0.59; 95% CI, –0.82 to –0.37; $P < .001$) (on average, +1.5 cm H_2O), higher residual AHI (Hedges' g, –0.34; 95% CI, –0.52 to –0.17; $P < .001$) (+2.8 events/h), and a poorer adherence (Hedges' g, 0.50; 95% CI, 0.21-0.79; $P = .001$) (–48 min/night).

CONCLUSIONS: Oronasal masks are associated with a higher CPAP level, higher residual AHI, and poorer adherence than nasal masks.

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ABBREVIATIONS: AHI = apnea-hypopnea index; NOS = Newcastle-Ottawa Scale

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OSA is characterized by repeated episodes of partial or complete pharyngeal obstruction during sleep.[1,2] OSA is extremely common in the general population[3-5] and is associated with nonrestorative sleep, excessive daytime sleepiness, impaired quality of life, and increased risk of cardiovascular complications.[6-9] CPAP is considered the "gold standard" treatment for patients with moderate to severe OSA. CPAP is able to abolish obstructive respiratory events, reduce excessive daytime sleepiness,[10,11] improve cognitive function and quality of life,[11] and reduce arterial blood pressure in those with hypertension.[12] However, CPAP efficacy depends on the appropriate use during sleep.[13]

CPAP for OSA treatment was originally designed to be used with a nasal interface. The rationale was that positive pressure through the nose and pharynx would push the soft palate and tongue forward.[14] Although oronasal CPAP violates this principle, two earlier studies have shown that oronasal CPAP is able to abolish OSA,[15,16] and it is frequently used[17,18] in clinical practice for the treatment of OSA. However, there is a growing concern that oronasal CPAP may compromise CPAP effectiveness to treat OSA.[19,20] A prior systematic review comparing CPAP interfaces has been published. However, because of limited available data at that time, the results were not clear.[21] The aim of this study was, therefore, to perform a contemporary meta-analysis of studies that compared the impact of nasal and oronasal CPAP for OSA treatment.

Methods

Literature Search

A systematic review was initially performed according to the Cochrane Collaboration group recommendations and the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA)[22] and Meta-analysis of Observational Studies in Epidemiology (MOOSE) guidelines.[23] Three authors (R. G. S. A., F. M. V., and J. A. N.) identified studies using the following terms: "sleep apnea" *and* "CPAP" *or* "sleep apnea" *and* "oronasal mask" *or* "OSA" *and* "oronasal CPAP" *or* "oronasal mask" *and* "adherence" in the Cochrane Central Register of Controlled Trials, Medline, and Web of Science. Case reports, case series, systematic reviews, and meta-analyses were excluded. This meta-analysis was registered in the PROSPERO database with the number CRD42017064584.

Retrieved articles were screened for relevant data and the studies were divided into randomized and nonrandomized trials. No language or time restrictions were applied. We also searched previously published studies, reviews, and meta-analyses that compared nasal and oronasal masks in OSA treatment. The search was performed from the first data available until April 4, 2017. Authors were contacted to provide additional information when data important for the present study were missing. Discrepancies were resolved by discussion or through a fourth investigator.

Quality Assessment

The methodologic quality of each trial was assessed with the Cochrane risk of bias tool for randomized trials,[24] which evaluates studies on the basis of selection, performance, detection, attrition, and reporting biases. The Newcastle-Ottawa Scale (NOS) was used for nonrandomized studies in order to assess methodologic quality.[25] The scale was not used as criterion for including or excluding articles. The evaluation of each article (NOS) is given as a score (number of stars) from three perspectives: (1) selection (maximum, four stars), (2) comparability (maximum, two stars), and (3) results (maximum, three stars). In the processing of the article quality analysis, a maximum of nine stars can be obtained for the high-quality studies. Studies of inferior quality obtain fewer stars.

Inclusion Criteria

Potential references were identified and screened by their title and abstract. After that, we retrieved the full article from selected articles. The inclusion criteria included (1) the original article, (2) randomized or nonrandomized trials, (3) adult patients with OSA who received nasal and oronasal CPAP, (4) CPAP level (in cm H_2O) measured by a technician during a CPAP titration night or with an automatic device, (5) residual apnea-hypopnea index (AHI; events per hour) evaluated by a technician during a CPAP titration night or with an automatic device, and (6) adherence (hours per night). Randomized and nonrandomized trials were included in this meta-analysis because of the small number of randomized controlled trials.

Data Extraction

The manuscript full text was retrieved after eligibility had been confirmed. Data were extracted by two independent investigators. The extracted data included the last name of the first author, year of publication, country, inclusion criteria, sample size, type of mask, patient characteristics, length of follow-up in each mask, CPAP level, residual AHI, and compliance. CPAP level, residual AHI, and CPAP adherence (mean ± SD) were extracted from the randomized and nonrandomized trials end points.

Statistical Analysis

All analyses were performed with the statistical package Stata 13.1 (StataCorp). Standardized mean difference (SMD) and 95% CIs were used for analyzing each study and the summary estimates. Hedges' g effect size instead of Cohen d was used because of the small sample size of some of the included studies. Values of 0.2, 0.5, and 0.8 are considered small, medium, and large effect sizes, respectively.[26] The random-effects model was used because not all the studies were functionally equivalent. Forest plots were graphically inspected, and publication bias was evaluated by Begg-modified funnel plot and Egger regression intercept test.[27] Heterogeneity was assessed by χ^2 test (Cochran Q, $P < .10$ for heterogeneity) and I^2 statistics (low heterogeneity, 25%; moderate, 50%; and high, 75%). Between-study variance was estimated with τ^2 ($\tau^2 > 0.1$ meaning substantial heterogeneity). We also performed sensitivity analysis by excluding one study at a time to assess the impact of each study on the overall results. Meta-regression