

Time spent talking in retirement

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Abstract

This paper describes the use of a voice accumulator to measure phonation time for healthy elderly retirees during daily activities. Twenty retirees, aged 66-75yrs, wore a VoxLog voice accumulator for three days during their usual activities. They kept a parallel activities diary, including their own judgments of how much talking they did, and an evaluation of the device's usability. Mean % phonation time was 9.9% (SD 5.6%), with a significant difference between women (12.8%, SD 5.6%) and men (7.0%, SD 3.5%). Self-judged amount of speaking was significantly correlated overall with phonation time. The participants were generally positive about using the device.

Index Terms: phonation time, VoxLog voice accumulator, retirees, communicative participation

1. Introduction

Modern portable voice accumulators are now sufficiently robust and reliable to study voice behaviours in naturalistic settings. They can monitor fundamental frequency, speech intensity (dB SPL), and phonation time over extended periods without recording speech content. Thus, they can be used to study vocal behaviour in everyday settings without compromising the integrity of the speaker. They have been used to study vocal loading in work environments for specific at-risk occupational groups such as teachers [1,2]. There are also studies of children's voices in preschool environments [1,3]. Recently, a clinical application was reported where a voice accumulator was used as a feedback device during daily activities of people who were being treated for soft voice associated with Parkinson's disease [4].

There is another potential clinical application of voice accumulators. We propose that the use of speaking time, which has been found to be proportional to phonation time [5,6], be investigated as a convenient indirect indicator of communicative participation for people with communication disorders such as dysarthria and aphasia. Treatments for these disorders include strategies for increasing communicative participation in daily living. Currently, treatment outcomes are measured using subjective estimations from the people themselves and their significant others. While self-perception provides essential clinical information regarding treatment strategies, it can be unreliable and inaccurate as a treatment outcome measure. Phonation time, measured for an extended period by a portable voice accumulator in people's usual environment, could be used as a convenient estimate of the amount of verbal communication, as a complement to, and verification of, changes reported by the people themselves. This has the potential to improve the accuracy and reliability of reported treatment outcomes.

Many of the people who seek treatment for dysarthria and aphasia are in older age groups, and often they have retired

from the workforce. Thus, if phonation time can be used as a treatment outcome measure for this group of people, reference data from healthy people within the same population will provide meaningful comparative data. While there are phonation time data available for various occupations within the working population, especially those at risk for high vocal loading, there is little information for the older retired population. There are recent studies that report phonation time during evening and weekend leisure activities for teachers [2,6,7], but these reflect the lifestyle of a younger population group. It is more likely that patients affected by dysarthria and aphasia will come from an older age group who have retired from the workforce. Thus, the aims of this study were (1) to measure phonation time during daily activities for a group of healthy retirees, using a VoxLog voice accumulator, (2) to compare phonation time with their self-estimated amount of talking, and (3) to evaluate their perception of VoxLog's ease of use for extended periods in their own environments.

2. Method

2.1 Participants

Twenty people (ten men and ten women), aged between 66 and 75 years (mean age 69 years), who were retired or semi-retired, were recruited via local senior citizen associations to participate in the study. Exclusion criteria were any known speech, voice or language disorders that required treatment and severe hearing impairment in the participants or their near relatives. Ten of the participants lived alone. All were native speakers of Swedish. For the two participants who were semi-retired, the recordings were made on days where they were not working.

2.2 Equipment

A portable voice accumulator, VoxLog (Sonvox AB, Umeå, Sweden) (Firmware version 2.2.3), designed for beyond-clinic use by patients with voice disorders, was used in this study. This lightweight device requires the user to wear an unobtrusive, snugly fitting collar around the neck that houses an accelerometer and microphone. The device measures voice fundamental frequency f_0 (Hz), voice intensity (dB SPL), phonation time (%) and level of background noise (dB SPL). Collected data are then transferred to a PC, and in this instance the recorded phonation times were analysed using VoxLog Connect 3.1.8 software. A photo of the device is shown in Figure 1, and a description of its operation can be found in Schalling et al. [4].

3.1 Questionnaire

The questionnaire used to investigate the participants' opinion of their experiences of using the VoxLog voice accumulator consisted of 24 items. The items were in the form of

statements such as “It was easy to use the VoxLog” and “It was difficult to attach the processor to my clothing”, with response categories “Agree completely”, “Agree to a large extent”, “Agree to a lesser extent” and “Do not agree at all”. The option “No opinion” was also available.



Figure 1: VoxLog lightweight portable voice accumulator.

4.1 Procedure

The participants wore the VoxLog voice accumulator for eight hours a day over three days, as they went about their usual daily activities. The days were not required to be consecutive and the device could be turned off during a recording day, as long as eight hours of recording were achieved. The participants were instructed to turn off the device while eating, bathing and in situations of high exertion, and to recharge the device each evening. They completed an activities sheet for each recording day, with times and types of speaking activities (e.g. telephone call). They were also asked to estimate how much they had talked each day, using a 100mm visual analogue scale (VAS) between 0 (very little talking) and 100 (a lot of talking). After the three days, the participants reported on their experience of using VoxLog, using the 24-item evaluation questionnaire and follow-up interview questions [4].

5.1 Data Analysis

The mean phonation time over three days was calculated for each participant, and thence means and standard deviations (SD) for the whole group, and for male and female groups separately. Differences in phonation times between the male and female groups were tested for statistical significance using a Mann Whitney U test.

The mean self-estimation VAS score (in mm) over the three days was calculated for each participant. Correlation between the 3-day means of phonation time and self-estimation VAS scores was tested using Spearman’s rho. The daily measures of phonation time and self-estimated amount of talking were ranked across the three days and then compared for each participant.

The evaluation questionnaire items were divided into six categories: user friendliness (5 items), the physical design (7 items), instructions (5 items), experience of wearing the device in public (4 items), technical problems (1 item) and overall impression (2 items). The responses to the questionnaire items were converted to ordinal scores from 1 (negative pole) to 4 (positive pole) and average group scores were calculated for each category.

3. Results

Although participants were instructed to use the VoxLog for a total of 24 hours (three separate days for eight hours on each day), the total recording time across the group varied from 19 to 39 hours, and for any one day the spread was 5-13 hours. The mean recording time for the group was 26 hours (SD = 4.5 hours). Nine participants registered non-contiguous recording hours within individual recording days, with one or more breaks, varying in duration between a few minutes up to 2.5 hours.

6.1 Phonation time

Mean phonation time for the group as a whole was 9.9% (SD=5.6%), with range 2.7-23%. For the subgroup of women (n=10), the phonation time was 12.8% (SD=5.9%), and for the men (n=10), it was 7.0 % (SD=3.5%) (Figure 2). Mann Whitney U testing showed that the difference between the two groups was significant (U=20, p=.023).

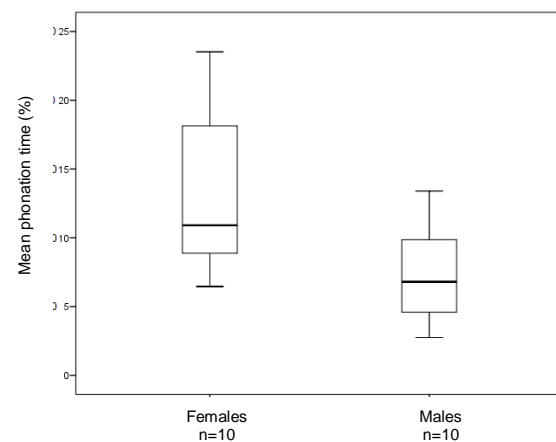


Figure 2: Box plots of phonation time for the subgroups of women and men.

7.1 Self-estimated amount of talking

The mean VAS score for the self-estimated amount of talking over the three days was positively and significantly correlated with the corresponding mean phonation time (Spearman’s $\rho = .72$, $p < .001$) (Figure 3).

With regard to the ability of individuals to rank their own amount of talking across the three days, the correspondence was less convincing, with only nine of them able to rank their daily self-estimations of amount of talking consistently with the corresponding phonation times.

8.1 Evaluation of VoxLog usability

A summary of the results of the average scores and SD for the six categories in the evaluation questionnaire on VoxLog’s usability can be seen in Table 1. Mean scores were all above 3 (of maximum 4), indicating that in general terms using the device was a positive experience. The lowest scoring category was wearing the device in public (3.29) and the highest (3.90) indicated a lack of technical problems with the device.

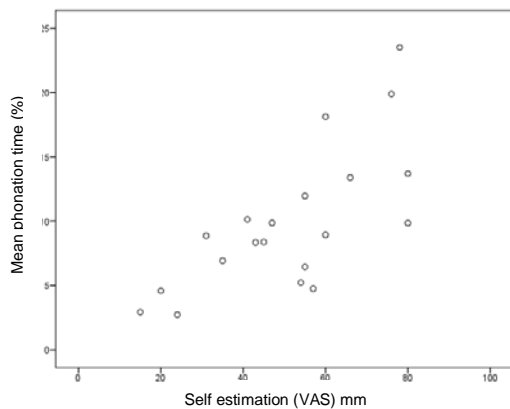


Figure 3: Scatterplot of mean phonation time over three days (%) against mean VAS estimation (mm) of amount of talking.

Table 1. Mean scores of VoxLog usability by category.

Category	Mean score (SD) (max=4)
User friendliness	3.62 (0.74)
Physical design	3.39 (0.98)
Instructions	3.58 (0.97)
Wearing in public	3.28 (1.29)
Technical problems	3.90 (0.45)
VoxLog overall	3.45 (1.08)

4. Discussion

The main purpose of this study was to use a portable voice accumulator to collect reference data for phonation time during typical daily activities for a group of retirees. The mean phonation time of 10% for the group is lower than the 12-13% out-of-work hours scores reported by Titze et al. [6] and the 14% by Hunter and Titze [2] for groups of school teachers, but higher than the 6% reported by Szabo Portela et al. [7] for a group of preschool teachers. Individual results in the current study showed large variability between participants (3-24%), as did the Szabo Portela study. Some of the variability in the current study may have been a reflection of the inadvertent variation from the intended 24 hours of recording time by some participants in the group. The relatively short recording periods in both the current and the Szabo Portela studies (three and two days respectively) may have also contributed to some of the variation. It may be necessary to consider a longer period to capture representative scores for use as clinical reference data.

The significantly larger mean phonation time for women compared with men is noteworthy. It contrasts with other findings for out-of-hours phonation times for teachers [2] where women's scores were just 1% higher than men's. It was considered possible that this result was related to living situations for our group, with a bias toward more men living alone. However, a check of the participants' background information showed that there were in fact more women than men who lived alone, which would have more likely biased

the scores in the opposite direction. Sociolinguistic studies on gender differences in the amount of time spent speaking have led Tannen [8] to the view that there are gender differences in the amount of talking, and they are dependent on the social circumstance. According to Tannen, men speak more than women in public forums, such as meetings, whereas it is women who speak more in more informal settings, such as a gathering of family friends. In the current study, an overview of the participants' activities sheets indicated that there were mainly informal activities with friends and family, and the larger phonation time for women result was thus consistent with Tannen's view.

The result from this study showed that there was quite good agreement between phonation time and self-estimated amount of speaking, when the mean scores over the three days are considered. This is a better result than has been reported previously [9], where there was not good correspondence between self-estimations and objective measures of phonation time. However, the day-to-day within-participant estimations showed that only nine people were able to rank their self estimates of time spent talking to be consistent with their phonation times. This lack of consistency to judge one's own speaking time from day to day supports the notion that sole reliance on patient self-reports to judge changes in speaking behaviour over a treatment period may be unreliable.

The evaluation questionnaire indicated that the participants were generally satisfied with using and wearing the VoxLog accumulator. This is consistent with a similar finding for the same device in a clinical application [4]. One issue that arose in follow-up interviews was the need for the collar to fit snugly around the neck. Not only is this an important issue for user comfort, but also a requirement for accurate measurement. The collar design has now been modified by the manufacturer to take account of this problem (<http://www.sonvox.com>). While the device was well tolerated amongst our participants, it should be remembered that it may be less well accepted by people who have speech and language disorders as a result of an illness. However, Schalling et al. found that patients with Parkinson's disease, aged 64-73yrs, were generally positive about using VoxLog as a feedback device during treatment for soft voice.

The generally positive reports of using and wearing the VoxLog are sufficiently encouraging to consider using the device to measure phonation time as a convenient clinical indicator of verbal communicative participation by people who have been affected by communication disorders. Such a proposal raises several questions: How good is phonation time as an estimate of speaking time? Is speaking time an adequate measure of communicative participation? Would being conscious of wearing the device impact on the patients' communicative behaviour?

In order to take advantage of the convenience and usability of a portable voice accumulator, and its ability to preserve a speaker's integrity by avoiding recording of speech content, we are faced with measuring phonation time rather than speaking time. Measures based on read speech [5] indicate that voiced speech comprises 50% of speaking time, with the other 50% divided between unvoiced speech sounds and silences. The proportions for spontaneous speech may differ from that, especially in regard to the proportion of silences. However, as long as phonation time remains consistently proportional to speaking time, then it is a valid indicator of speaking time.

The suggestion that speaking time can act as a marker for the degree of communicative participation is the key

assumption of our proposed clinical application. Communicative participation has been defined as “taking part in life situations where knowledge, information, ideas or feelings are exchanged” [10]. Speaking time captures the frequency and duration of episodes of talking, but it cannot discriminate whether the talking is part of a communicative exchange. In daily living, most episodes of talking are part of a communicative exchange, but there is potential for speaking time measures to introduce anomalies.

Overall, the convenience and objectivity of the measure has appeal as potential clinical application. Indeed, a small increase in phonation time was reported during a trial where a voice accumulator was used as a feedback device to improve vocal loudness [4]. Such an increase could have reflected a coincidental improvement in communicative participation because the person found that they were more easily understood. But it could also reflect an awareness of the device’s presence which may have impacted on the amount of talking. Indeed, this issue has been raised in the context of data collection for teachers [11] and may well impact the behaviour of people using the device to monitor the success of treatment.

5. Conclusion

This study used the VoxLog portable voice accumulator to report phonation times for a group of retirees. Self-judged amount of speaking was significantly correlated overall with phonation time for the group as a whole. The experience of using the device was generally positive. The study provides some initial reference data that could be used for a novel clinical application of a voice accumulator to monitor phonation time as a marker of amount of communicative participation by older people who have communication disorders such as dysarthria or aphasia.

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