Speech Intelligibility Enhancement Through Maxillary Dental Rehabilitation with Telescopic Prostheses and Complete Dentures: A Prospective Study Using Automatic, Computer-Based Speech Analysis

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Purpose: A completely edentulous or partially edentulous maxilla involving missing anterior teeth may impact speech production and lead to reduced speech intelligibility. The aim of this study was to prospectively evaluate the effect of a dental prosthetic rehabilitation on speech intelligibility in patients with a toothless or interrupted maxillary arch by means of an automatic, standardized speech recognition system. ***Materials and Methods:*** The speech intelligibility of 45 patients with complete tooth loss or a loss including missing anterior teeth in the maxilla was evaluated by means of a polyphone-based automatic speech recognition system that assessed the percentage of correctly recognized words (word accuracy). To replace inadequate maxillary removable dentures, 20 patients from the overall sample had been rehabilitated with complete dentures and 25 patients with telescopic prostheses. Speech recordings were made in four recording sessions (with and without existing prostheses and then at 1 week and 6 months after placement of newly fabricated prostheses). ***Results:*** Significantly higher speech intelligibility was observed in both patient groups compared to the original results without the dentures inserted. After 6 months of adaptation, both groups had reached a level of speech quality that was comparable to the healthy control group. However, patients receiving new telescopic prostheses showed significantly higher levels of speech intelligibility compared to those receiving new complete dentures. Within 6 months, speech intelligibility did not significantly improve from the level found 1 week after insertion of new prostheses for both groups. ***Conclusion:*** Patients benefit from the fabrication of new dentures in terms of speech intelligibility, regardless of the type of prosthesis. However, telescopic crown prostheses yield significantly better speech quality compared to complete dentures. *Int J Prosthodont 2012;25:24–32.*

Complete or partial loss of teeth can cause a persistent speech disorder and severely reduce the intelligibility of speech through the impact of prosthetic treatment on articulation.[1] Maxillary anterior teeth in particular are crucial for adequate speech intelligibility, and their rehabilitation improves articulation abilities.[2,3] Removable complete and partial dentures may provide some solutions.[4] However, they may also disturb speech production by restricting the flexibility of the tongue, narrowing the oral cavity, and altering the articulation areas of the palate and teeth.[1,5]

The quality of speech production significantly affects patients' general satisfaction with dentures, and patient contentment in turn correlates with acceptance of the dentures.[6] A method that allows for the objective and independent assessment of speech has not yet been presented, and there is no standardized assessment for speech disorders in adults

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Table 1 Patient Demographics for Prosthesis Type

	Complete denture			Telescopic prosthesis			Total		
	Women	Men	Total	Women	Men	Total	Women	Men	Total
No. of patients	8	12	20	15	10	25	23	22	45
Mean age ± SD (y)	62.6 ± 6.6	63.8 ± 9.0	63.4 ± 8.0	62.0 ± 9.8	63.5 ± 10.0	62.9 ± 8.9	62.2 ± 8.8	63.7 ± 9.3	62.9 ± 8.9
Age range (y)	55.0–73.0	48.0–78.0	48.0–78.0	48.0–78.0	44.0–82.0	44.0–82.0	48.0–78.0	44.0–82.0	44.0–82.0

SD = standard deviation.

or children at the national or international level.[7,8] Therefore, semi-standardized instruments for the analysis of speech disorders are common.[9,10] Auditory perception by speech therapists is the state of the art in analyzing speech intelligibility as the overall phonetic outcome of dental rehabilitations.[4,11,12] However, the assessment of speech disorders or intelligibility by professionals is highly subjective and shows limited reliability because of differences in speech therapists' experiences as well as variable test conditions.[13] This is accompanied by a lack in repeatability of the evaluation results. Transcription tasks and multiple-choice tasks by multiple evaluators are considered to be suitable for obtaining reliable results.[14] However, the use of multiple evaluators is rather time-consuming and has mainly been used for research projects.

Objective and independent diagnostic tools for the assessment of speech quality concerning dental parameters have only been applied to single parameters of speech.[1–3,5,12,15] However, this does not allow for deriving a global measure of speech quality as a fundamental attribute of real-life communication. A computer-based technique for the objective evaluation of speech intelligibility has long been introduced as a diagnostic tool in adult patients who suffer from neurologic diseases[16] or who stutter,[17] in laryngectomees with tracheoesophageal speech,[18] and in children with cleft lip and palate.[19] The method has recently been evaluated for the automated analysis of edentulous patients and patients with complete dentures.[20] A validation of this system demonstrated strong correlations between experts' ratings of intelligibility and the automatic assessment of word accuracy[18,19,21] for each of the different investigations.

In this study, speech intelligibility was evaluated in patients with a completely edentulous or partially edentulous maxillary arch involving missing anterior teeth before and after prosthetic rehabilitation by means of automated speech analysis. Two types of prostheses (complete dentures and telescopic prostheses) were chosen to analyze the outcome of speech intelligibility. The purpose of the present investigation was to perform an explorative comparison of change of speech intelligibility over time for the two types of prostheses.

Materials and Methods

The sample comprised 45 patients (23 women, 22 men; mean age: 62.9 ± 8.9 years) with an edentulous or reduced maxillary dental arch involving missing anterior teeth in need of a new maxillary removable prosthesis (Table 1). Patients were recruited from the Department of Prosthodontics, University Hospital of Erlangen, Erlangen, Germany. All participants were native German speakers who spoke a local dialect. None of the patients had speech disorders caused by medical problems other than dental issues, and there were no reported hearing impairments.

The control group included 40 subjects with complete natural dentitions and no speech disorders (10 women, 30 men; mean age: 58 ± 13 years; range: 28 to 82.1 years). These subjects also served as the control group in a previous study presenting preliminary results on automatic speech recognition.[20]

All patients provided written consent for their participation in the present investigation. The study respected the principles of the ethics committee in charge as well as the Helsinki Declaration of 1975/1983 and was approved by the ethics committee of the University of Erlangen-Nuremberg (approval no. 3816).

Dental Charts

A subgroup of 20 subjects had completely edentulous maxillae at the time of the first dental record and was rehabilitated by means of a complete denture. The subgroup that was rehabilitated with a maxillary telescopic prosthesis was categorized pursuant to the Kennedy classification and was additionally categorized by the extent of tooth loss in the maxillary anterior area (Table 2). In both subgroups, there was no change to the dental chart concerning the

Table 2 No. of Missing Anterior Teeth and Kennedy Classification for Patients Receiving New Telescopic Prostheses

No. of missing teeth	Kennedy Class I	Kennedy Class II	Kennedy Class III	Kennedy Class IV
5–6	3	0	0	0
3–4	8	1	0	0
≤ 2	4	3	4	2
Total	15	4	4	2

Table 3 Inadequate Maxillary Dentures Prior to Investigation and Opposing Mandibular Prostheses

	One-piece cast framework denture	Complete denture	Fixed partial denture	Telescopic prosthesis	None
Maxillary dentition	13	20	10	2	0
Mandibular dentition	8	6	11	14	6

extraction of teeth during the study. Prior to prosthetic treatment, all participants had been wearing removable maxillary dentures for at least 5 years. Pre-existing dentures as well as the opposing mandibular dentition are shown in Table 3. The majority of these dentures were not fabricated in the authors' clinic. The maxillary dentures were assessed to be inadequate according to the following aspects.

Assessment of Dentures

The following criteria were used to assess the need for prosthetic treatment and the quality of newly fabricated prostheses in this study. Each parameter was rated as adequate or inadequate by one senior dentist from the Department of Prosthodontics, Dental School, University Hospital of Erlangen.

- Absence of pain concerning the masticatory muscles and soft and hard tissues in functional and nonfunctional situations
- Absence of variances of the soft tissue, such as redness or ulcers
- Ability to chew and swallow without restrictions
- Balanced functional occlusion
- Interocclusal distance of 2 mm in a physiologic resting position
- Excellent fit proven by a soft pattern (a silasoft N probe [Detax] that was applied to the bottom of the prosthesis, fitted on the dental arch, and checked for irregularities after hardening)
- Patient satisfaction

Whenever one of these parameters was evaluated to be inadequate or if the patient did not wear any dentures, new dentures were recommended.

Dentures

In a follow-up treatment, the inadequate prostheses were replaced with either complete dentures or a telescopic prosthesis. All newly fabricated dentures were adequate concerning the aforementioned parameters. Detailed descriptions of the newly fabricated as well as pre-existing prostheses are shown in Tables 1 and 3.

Complete Dentures. Edentulous patients were rehabilitated with complete dentures. All maxillary complete dentures were constructed with a palatal seal for denture retention. Care was taken to avoid excessive palatal thicknesses, with a maximum of 2.5 mm (range: 1.5 to 2.5 mm). The extension of the denture base was kept as small as possible. All complete dentures were made using polymethyl methacrylate resin.

Telescopic Prostheses. Partially edentulous patients were rehabilitated with telescopic prostheses. The newly fabricated telescopic prostheses were categorized as sliding cap attachments with cemented inner copings and removable outer crowns, also called double crowns. The coping and crown were in contact with their parallel sides. The retainer components were slid into each other and provided a precise fit and stability. A single chromium-cobalt alloy palatal bar was used as the major maxillary connector to provide cross-arch stability and positioned with as little impact on articulating areas as possible, without lowering static parameters. Whenever possible, the cross section used was a palatal bar, which resulted in less palatal coverage than palatal plates. The palatal bar was individually fabricated and dimensioned, taking into account the interindividual rigidity and support requirements. Soft tissue support was applied only if the required support for the prosthesis could not be provided by the quantity or position of the residual teeth. However, 10 patients were rehabilitated with full palatal extensions to ensure cross-arch stability. All new dentures were peer-reviewed with regard to the aforementioned assessment parameters and considered to be adequate by a senior dentist from the Department of Prosthodontics, Dental School, University Hospital of Erlangen.

Speech Recordings

Speech samples were recorded during patients' regular outpatient examinations on three specific dates. Participants were recorded reading a standardized text out loud. The first speech recording was performed prior to treatment to obtain baseline data. These first recordings were made both without any dentures and with the inadequate dentures inserted—if dentures for the maxilla existed at that point of time. Otherwise, these first speech recordings were made before and after the removal of inadequate artificial teeth, ie, fixed partial dentures. A second speech recording was performed 1 week after the insertion of the newly fabricated prostheses. To take into account the patients' habituation to the new prostheses, recordings were made 6 months after the insertion of the new dental prostheses.

All speech samples were recorded at 16 kHz with 16-bit quantization using a close-talking microphone (Call4U Comfort-Headset, DNT). Patients were asked to read the German version of the text *The North Wind and the Sun*, a fable by Aesop that is also utilized as a referee text by the International Phonetic Association and is widely used for phonetic research on an international level. This phonetically balanced text contains 108 words, of which 71 are unique, and 172 syllables. It includes all possible phonemes of the German language. On average, it takes 43 seconds to read the text aloud, ie, the average reading speed is four syllables per second.

For the speech-recording procedure, the text was divided into 10 passages using major syntactic boundaries (ie, sentences) to provide text displays on the screen using large letters that were easy to read. The recording software automatically segmented the audio data according to these boundaries.

Automatic Speech Recognition System (PEAKS)

For objective intelligibility assessment, the PEAKS system (program for evaluation and analysis for all kinds of speech disorders) was applied. This is a state-of-the-art speech recognition system developed by the authors' workgroup at the Chair for Pattern Recognition, Department of Computer Science, University of Erlangen-Nuremberg. The latest version was used in the present study, as described in detail by Stemmer.[22] PEAKS is familiar with all of the phonemes of the German language and also with morphosyntactic rules.

Recognition is performed using semicontinuous hidden Markov models (SCHMMs), which describe the likelihood of an analyzed acoustic signal being identical to a specific phoneme. The codebook contains 500 full covariance Gaussian densities, which are shared by all HMM states. The speech recognition system has a so-called multigram language model. The probability of recognizing a word depends on the acoustic signal (obtained by the hidden Markov models) and the probability that this word follows the last spoken (bigram) or the two last spoken words (trigram).

The computed temporal and spectral characteristics are compared to word models given by acoustic speech samples, with corresponding transliteration from the VERBMOBILE project.[23] These describe the likelihood of an acoustic signal being identical to a certain phoneme. This way, the probability for each word can be obtained. At the end, the recognized word chain is calculated as the most likely sequence of words to match a spoken text.

Speech Assessment

Word accuracy (WA) was computed as a measure for the speech intelligibility score. WA is a standard measurement for evaluating recognizers and indicates the deviation of a recognized sequence of words from the spoken utterance, ie, WA represents the percentage of correctly recognized words. It is calculated as follows:

$$WA\ [\%] = (C - W) / R \times 100\%$$

C denotes the number of correctly recognized words, W the number of wrongly inserted words, and R the number of words in the reference text.[21,23,24] WA was validated to be a reliable measure for speech intelligibility concerning the outcome of a prosthetic rehabilitation.[20]

Table 4 Comparison of Word Accuracy for Speech Intelligibility with Complete Dentures

	WA, mean ± SD (range)	n	Edentulous	Dentures (ia)	Dentures (a) after 1 wk	Dentures (a) after 6 mo
Edentulous	53.38 ± 15.27 (13.89–75.00)	20	–	.0277	.0002	.0002
Dentures (ia)	58.27 ± 16.37 (5.56–74.07)	20	.0277	–	.0300	.0412
Dentures (a) after 1 wk	62.69 ± 16.50 (2.78–76.89)	20	.0002	.0300	–	> .9999
Dentures (a) after 6 mo	64.10 ± 13.02 (25.00–78.70)	20	.0002	.0412	> .9999	–
Control group	69.79 ± 10.60 (32.40–88.00)	40	1.2943e–005	.0019	.0480	.0750

WA = word accuracy; SD = standard deviation; ia = inadequate; a = adequate.

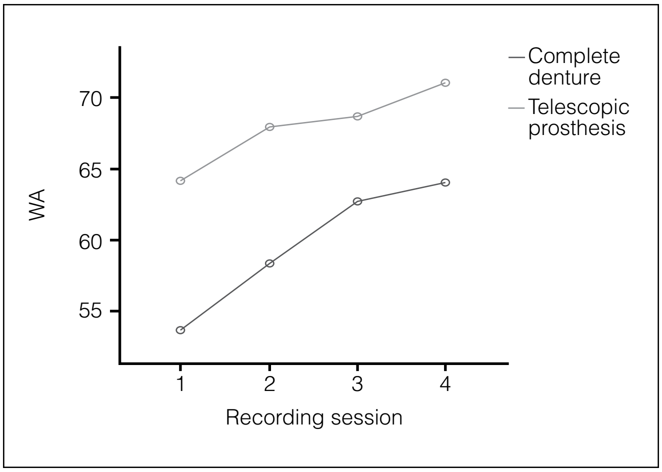

Fig 1 WA during the four recording sessions: *(1)* WA without any dentures, *(2)* WA with inadequate dentures, *(3)* WA 1 week after fabrication of new dentures, and *(4)* WA 6 months after fabrication of new dentures.

Statistics

The Levene test was used for testing the homogeneity of variance, and the Shapiro-Wilk test for proof of normal distribution. If not indicated otherwise, the statistical preconditions were given for all tests conducted. The comparison of WA was performed using a univariate analysis of variance (ANOVA) and repeated-measures ANOVA after the Bonferroni correction, followed by post hoc tests. *P* values equal to or less than .05 were considered to be statistically significant. All statistical tests were performed using SPSS version 17 for Windows (IBM).

Results

Speech Intelligibility

Complete Dentures. For edentulous patients, WA was significantly lower when not wearing a prosthesis at all (mean: 53.38 ± 15.27, range: 13.89 to 75.00) compared to wearing an inadequate denture (mean: 58.27 ± 16.37, range: 5.56 to 74.07) or a new complete denture 6 months after fabrication (mean: 64.10 ± 13.02, range: 25.00 to 78.70). Wearing an inadequate complete denture showed significantly lower levels of WA compared to 1 week (P = .030) and 6 months (P = .041) after wearing a new denture. Compared to the control group, significantly lower WA was observed 1 week after insertion (P = .048), while no significant difference was found after 6 months. The improvement of WA in the habituation period between 1 week and 6 months was not significant (Table 4, Fig 1).

Telescopic Prostheses. In the group of patients who were rehabilitated with telescopic prostheses, WA was significantly higher 1 week (mean: 68.66 ± 9.22, range: 43.52 to 80.56, P = .0158) and 6 months after rehabilitation (mean: 71.11 ± 9.80, range: 48.15 to 83.21, P < .001), compared to not wearing a prosthesis. On a descriptive level, rehabilitation with a telescopic prosthesis showed the highest speech

Table 5 Comparison of Word Accuracy for Speech Intelligibility with Telescopic Prostheses

	WA, mean ± SD (range)	n	Without dentures	Dentures (ia)	Dentures (a) after 1 wk	Dentures (a) after 6 mo
Without dentures	64.16 ± 9.83 (41.67–75.93)	25	–	.1065	.0158	.0006
Dentures (ia)	67.96 ± 10.27 (43.52–83.33)	25	.1065	–	> .9999	.5906
Dentures (a) after 1 wk	68.66 ± 9.22 (43.52–80.56)	25	.0158	> .9999	–	.2025
Dentures (a) after 6 mo	71.11 ± 9.80 (48.15–83.21)	25	.0006	.5906	.2025	–
Control group	69.79 ± 10.60 (32.40–88.00)	40	.0363	.4970	.6656	.6169

WA = word accuracy; SD = standard deviation; ia = inadequate; a = adequate.

intelligibility 6 months after rehabilitation (mean: 71.11 ± 9.80) compared to all subgroups investigated in this study (Table 5). In particular, no significant difference was noted compared to the WA of the control group (P = .61). The improvement of WA in the habituation period between 1 week and 6 months was not significant (Table 5).

In assessing WA for this patient group prior to the rehabilitation process, it was found that patients wearing inadequate one-piece cast framework dentures or telescopic prostheses performed the speech test without a significant difference (mean: 67.96 ± 10.27, range: 43.52 to 83.33) compared to the same patients not wearing a prosthesis at all (mean: 64.16 ± 9.83, range: 41.67 to 75.93; P = .12) (Table 5, Fig 1).

Comparison of Change in WA

A significantly higher WA was found for patients wearing telescopic prostheses compared to patients wearing complete dentures after the adaptation period of 6 months (P = .046). There was a significant improvement in completely edentulous patients after the insertion of a new denture compared to inadequate dentures (P = .030), but no significant improvement was found for partially edentulous patients when the pre-existing prosthesis was replaced with a new telescopic prosthesis (P > .9999). However, the baseline values for completely edentulous patients and partially edentulous patients were significantly different (Tables 4 and 5).

Discussion

In the present investigation, an assessment of the effect of maxillary dentures on speech intelligibility was carried out, and for this purpose, the speech data of two groups were analyzed before and after the fabrication of new dentures. Forty-five patients had their speech recorded in four recording sessions: with and without their inadequate dentures in situ as well as 1 week and 6 months after the fabrication of new dentures, with either complete dentures or telescopic prostheses. Speech intelligibility was measured using PEAKS, an automated speech recognition system that calculated WA for each patient.

Without a dental prosthesis inserted, both groups showed that speech intelligibility was significantly lower compared to any other measurement data with dentures inserted. In agreement with the present study, with dentures inserted, an improvement in the intelligibility of patients with an edentulous or partly edentulous maxillary arch was stated in studies that used a perceptual rating of speech intelligibility[1] or spectral analysis to assess single distorted sounds.[5,9] In these studies, the articulation of fricative sounds or consonants in particular posed a problem for edentulous speakers, which may explain reduced speech intelligibility. In particular, the impact of maxillary teeth and palatal coverage on speech production was noted. The maxillary incisors and their positions were found crucial for speech production,[5] and there are various studies concerning the effects of the size and surface of the denture base on speech production.[25–28] Also, the loss of maxillary teeth was stated as a possible explanation for speech sound distortions, but no clear relationship could be identified between different oral and prosthetic factors.[9] Even though a certain influence of the mandibular dentition and type of prosthesis seems reasonable, only few data can be found in the literature regarding this matter, and these data also mostly concern subjective evaluations of the quality of life. Studies in this area implicate that the mandibular prosthesis and its fixation seem to influence masticatory function or stability to a greater extent than does speech production.[29–33] Therefore, the authors focused on the maxilla and its dentition in the present study. When comparing the speech data to a control group, it was noticeable that after 6 months, both groups had reached a level of speech quality that was comparable to the healthy control group. Hence, it is assumed that adequate maxillary dentures can restore speech intelligibility to an acceptable or even comparable level with both types of prostheses. However, significantly higher speech intelligibility was observed in patients wearing adequate telescopic prostheses compared to complete dentures after the completion of the 6-month habituation period. A possible explanation may be the fact that complete dentures lack dental support and fixation, factors that are known to be important for an exact fit and reliable stability. Hence, macro- and micromovements of the mucosal base may interfere with articulation, reducing the intelligibility of speech. This assumption is supported by the results of a patient questionnaire that showed that fixed implant prostheses provide better speech intelligibility than complete dentures because of better fixation of the prostheses in the oral cavity.[34] Additionally, the palatal coverage itself and its influence on the geometry of the oral cavity are known to be main factors for reduced speech intelligibility in wearers of complete dentures.[1,3,5] Palatal coverage hinders the tactile feedback mechanisms to a large extent, and therefore limits the ability to properly articulate.[9] Since every alteration of the oral cavity may cause an impairment of speech production, it is consequently assumed that it is more challenging to adapt to prostheses with extended palatal coverage. Still, the alternative interpretation of these results—that differences in speech intelligibility prior to the insertion of new prostheses account for the differences in WA after rehabilitation—must be acknowledged. Because of significant differences in speech intelligibility from the beginning, it is not possible to state statistically valid information about these parameters in the current study. Therefore, further randomized clinical trials are needed to investigate the factors that are most crucial for alterations of speech intelligibility in patients wearing different types of dentures.

In various studies, the influence of time on speech production was highlighted with regard to the habituation to dental prostheses.[4,11] These studies report that 90% of patients only reach a steady state of speech quality after a period of at least 2 to 4 weeks.[4] Other studies assume an even longer habituation period, but only acquired these results for single sounds, such as /s/ and /th/[11] or for patients with implant-supported prostheses.[12,15] To investigate the habituation effect, the last collection of speech data was carried out 6 months after dental rehabilitation with adequate prostheses. That way, the completion of individual habituation was assured and the process could be depicted over a certain period of time. In accordance with the aforementioned studies, the habituation process was mainly completed at the first recording after a 1-week adaptation, and no significant improvement of speech intelligibility could be shown afterward. Hence, a prominent role within the 6-month adaptation period in speech intelligibility could not be affirmed for either type of prosthesis. However, it must be noted that over 77% of patients had worn inadequate removable dentures prior to the fabrication of the new dentures (Table 3). Therefore, in the current study sample, the habituation process to removable dentures could have been accelerated because of an already existing neural and proprioceptive adaptation to prostheses in most of the subjects.

The comparison between inadequate and newly fabricated adequate complete dentures yielded a significant melioration of speech intelligibility. These data support the findings of a prior study conducted by the authors that found a significant improvement in speech intelligibility when wearing adequate complete dentures compared to inadequate ones.[20] With regard to telescopic prostheses, a tendency toward higher speech intelligibility levels with adequate prostheses could only be shown when comparing newly fabricated prostheses with inadequate partial prostheses. This conclusion must be tempered by regard for the particular research design of the present study. Because the inadequate dentures of the partially edentulous patient group comprised different types of dentures and different positions and numbers of remaining teeth, a varying number of factors may have had an effect on speech production. Further studies are necessary to investigate the influence of these factors on speech intelligibility.

Speech intelligibility is a global parameter for the success of a prosthetic rehabilitation. Recently, a computer-based, automatic, rater-independent speech recognition system for the objective investigation of speech intelligibility was introduced by the authors' workgroup.[23,24] This technique is based on the WA of spoken language as a means of representing intelligibility through speech recognition techniques. Of course, WA is not similar, but rather akin to intelligibility. Both are influenced by voice quality, phonematic and morphosyntactic structure, amplitudes, and speaking velocity. Intelligibility also includes the "human factor." Even if the listener does not understand every word or syllable of a spoken sequence, the meaning can be understood by extrapolating from contextual, pragmatic, and prosodic characteristics. Although there is a good correlation to intraindividual listeners' evaluations of speech intelligibility, it shows considerable variability, which reveals the limitations of speech assessment by listeners.[13,14] The system was positively validated for edentulous patients being rehabilitated with complete dentures by comparing the WA scored by the automatic system to the perceptual evaluation by experts. These findings are consistent with results collected from patients with neurologic diseases, patients who stuttered, laryngectomees with tracheoesophageal speech,[18] children with cleft lip and palate,[19] and patients with oral squamous cell carcinoma.[21] In this study, neither the participants of the study group nor those of the control group reached 100% on the WA scale. However, absolute WA, ie, 100%, is not crucial, since it is dependent on the training population as well as on the adaptation of the system, and therefore presents a result of relative comparison. Another aspect may be the influence of different dialects on speech intelligibility assessment. Therefore, the automatic recognition system was trained on an initial data set that contained data from speakers from all over Germany. It was shown in a former study that there are no significant differences between the WA in different German dialects.[23]

Conclusion

In the present investigation, it was possible to demonstrate the impact of two different types of prosthetic rehabilitation on speech production by performing an objective and automatic speech analysis. The process of habituation to newly fabricated dental prostheses, including previously fabricated inadequate prostheses, was demonstrated over a period of time. A statistically significant improvement in speech intelligibility was noted by rehabilitating the patients with complete dentures as well as with fixed removable prostheses, such as telescopic prostheses, after 1 week of adaptation to the newly fabricated prostheses. This leads to the conclusion that prostheses can generally contribute to an improvement of speech production, regardless of the type of prosthesis, and this improvement does not necessarily take up to 6 months in patients that had previously been rehabilitated with dental prostheses. The automatic speech recognizing system (ASR) can provide an objective information base for patients with regard to the speech intelligibility outcome of their dental rehabilitation process. Additionally, the ASR may assist clinicians in terms of quality management: Applying the ASR, clinicians can easily supervise and control the speech intelligibility of their patients throughout the process of dental rehabilitation. Additional investigations concerning speech intelligibility in prosthesis wearers should focus on single factors, such as the influence of palatal coverage or implant-supported prostheses versus soft tissue support. Regarding these parameters, which can be varied by the clinician, a statement of the outcome of speech intelligibility for each case could support the clinician and patient in their decision to choose a prosthesis that minimally affects the intelligibility of speech.

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Literature Abstract

Oral health and cancer-, cardiovascular disease–, and respiratory disease–related mortality of a Japanese elderly population

This cohort study investigated the association between oral health status and three major causes of mortality among a Japanese elderly population: cardiovascular disease, respiratory disease, and cancer. In 2003, 9,783 participants in the Aichi Gerontological Evaluation Study (AGES) project received three versions of a self-administered questionnaire. By 2008, mortality data from 4,425 respondents were analyzed. Oral health status was categorized as having 20 or more teeth, 19 or fewer teeth with no eating difficulty, or 19 or fewer teeth with eating difficulty. A multivariate Cox proportional hazard model was used to investigate the hazard ratios of oral health status for three types of mortality. Covariates included sociodemographic characteristics, lifestyle, and medical condition. The analysis showed significant association between poor oral health and greater mortality from cardiovascular (n = 108) and respiratory disease (n = 58) even after adjusting for all covariates. The hazard ratio for cardiovascular disease and respiratory disease mortality in respondents with 19 or fewer teeth and eating difficulty were 1.83 and 1.85 times higher, respectively, when compared with respondents with 20 or more teeth. Association between cancer mortality (n = 159) and oral health was not significant. The authors concluded that in community-dwelling Japanese elderly, cardiovascular and respiratory disease mortality can be associated with oral health status. However, cancer mortality could not be predicted by oral health in this group of patients.

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