

# A CLINICAL RATING SCALE OF SPEECH DYSFUNCTION IN PARKINSON'S DISEASE

THOMPSON, ALISON K., B.A. (SP. & H.TH.) (WITWATERSRAND)  
*Speech Therapy Department, General Hospital, Johannesburg.*

## SUMMARY

The speech dysfunction of Parkinson's disease is complex and individually variable owing to the interaction of muscle rigidity, tremor and disturbance of movement. Eight speech dimensions which are characteristically disturbed in Parkinson's disease are discussed with reference to available research findings. In order to provide a more detailed description of the speech than could be obtained by clinical notes alone, a speech rating scale has been developed, and is presented in summarized form for clinical use. Incidence and progression of the speech dysfunction are considered in addition to the problems of assessment peculiar to the patient with Parkinson's disease.

## OPSOMMING

Die spraakdisfunksie van Parkinson se siekte is kompleks en verskil van persoon tot persoon, as gevolg van die interaksie van spierstyfheid, tremor en versteuring van beweging. Agt aspekte van spraak wat kenmerkend versteurd is in Parkinson se siekte word bespreek met verwysing na die bevindinge van navorsing. 'n Spraakgraderingskaal is ontwikkel om 'n meer volledige beskrywing van spraak te verkry as wat moontlik is met die gebruik van kliniese aantekeninge alleen en dit word opgesom vir kliniese gebruik. Die voorkoms en ontwikkeling van die spraakdisfunksie word in oënskou geneem, asook die probleme by evaluasie wat eie is aan die pasiënt met Parkinson se siekte.

Parkinson's disease is characterized by a combination of muscle rigidity, tremor and disturbance of movement. This disturbance may take the form of slowness of movement (bradykinesia), paucity of movement (hypokinesia) or difficulty in initiating movement (akinesia). The fact that this triad of symptoms occurs to a variable degree in any given patient means that each patient presents with his own individual pattern of both physical and speech dysfunction. Speech disturbance, which is generally present to some degree, results from the inability to co-ordinate and integrate the various elements which comprise the motor-speech act.

Although laboratory techniques have been used to describe the different speech features of Parkinson's disease objectively, these are neither practical nor available for everyday clinical use. Furthermore, Sarno<sup>18</sup> notes that a patient's intelligibility rating does not necessarily correlate with the degree of motor impairment observed in the speech musculature or with an acoustic description of the speech production. The task of assessing the patient's speech therefore ultimately falls to the clinician who must use subjective judgements together with those recording techniques which are available.

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Owing to the complexity and individual variation noted in the speech dysfunction of the Parkinson's patient, it was felt that a consideration of each discrete speech dimension would lead to a better understanding of the precise nature and level of the patient's speech functioning than could be obtained from clinical notes alone. As speech performance is one index of the patient's general level of functioning, this information is of assistance in the formulation of decisions for ongoing medical management. Research studies have provided data on the sequence of speech deterioration with progression of the disease.<sup>13, 14</sup> The course of the patient's speech deterioration can therefore be determined with the aid of a detailed speech assessment obtained at regular intervals.

This article describes a clinical rating scale which has been developed to permit a systematic recording of eight speech dimensions which are characteristically disturbed in the Parkinson's disease patient. The range of dysfunction pertaining to each speech dimension is discussed in some detail, thereby providing a base reference for applying the scales which are presented in summarized form for clinical use. Whilst the scales cannot claim to be fully comprehensive, they provide a simple and practical means of recording clinical judgements for future reference.

#### INCIDENCE AND PROGRESSION OF SPEECH DYSFUNCTION

On subjective evaluation, reduced intensity of speech and monotony are frequently the earliest presenting signs of speech disturbance. Laryngeal functioning is generally affected early in the disease process, followed by a deterioration in lingual, and finally labial functioning. Canter<sup>5</sup> demonstrated that in 17 patients tongue-tip involvement was typically greater than lip involvement.

Blonsky et al.<sup>1</sup> investigated the speech of 100 patients with Parkinson's disease using cinefluoroscopic techniques. The following incidence of dysfunction was found, (listed below in order of their presentation in the disease process):

Hoarseness	90 %
Vocal tremor	30 %
Lingual dysfunction	50 %
Labial dysfunction	30 %
Dysfluency/stuttering	20 %

Logemann et al.<sup>13</sup> classified the voice and articulation defects of 150 patients by perceptual evaluation. They found that many patients had voice disorders in the presence of normal articulation but the converse was true in only one patient. Voice disabilities appear to develop before articulation begins to degenerate. Their analysis of the sequence of articulatory degeneration reveals that deterioration progresses from posterior to anterior tongue positions of articulation. First phonemes affected are /k/ and /g/, followed by /s/ /z/, then /ʃ/ /ʒ/, and then /č/ /j/. Last to be affected are /t/ and /d/. The labial phonemes /p/ /b/ /f/ and /v/ were affected after /k/ and /g/, usually about the time that /č/ and /j/ deteriorated.

They report the following incidence of speech dysfunction:

Voice disorders (hoarseness, breathiness and roughness)	89 %
Articulation disorders	45 %
Rate disorders	20 %
Nasality	10 %
Unimpaired speech	10 %

Considering that one might predict nasality in Parkinson's patients owing to rigidity and hypokinesia of the velum, it is noteworthy that this is not a characteristic feature of the condition. The Logemann et al<sup>13</sup> incidence of 10 % may reflect normal distribution factors.

The relationship between the nature of speech disturbance and the patient who presents with either a predominance of tremor, rigidity or bradykinesia is not clear. The relative interaction of these signs in the individual would appear to be responsible for the considerable variation in speech disturbance noted between patients. The speed of speech, which can be either abnormally fast or abnormally slow, provides a good example of this variability in presentation.

#### FACTORS INFLUENCING ASSESSMENT

There are several factors to be considered when assessing speech performance of the Parkinson's disease patient.

#### Medication

Dopaminergic drugs, if well tolerated by the patient, generally result in improved speech.<sup>14, 17</sup> Leanderson et al<sup>11</sup> obtained EMG recordings of patients before and during L-dopa treatment. The untreated patient demonstrated a constant muscular hyperactivity which interfered markedly with articulation. A further finding was a disturbance in reciprocal muscular activation, manifested in a simultaneous contraction of opposing articulatory muscles. The primary action of L-dopa was a reduction in hypokinesia, thereby resulting in both improved speech and facial movement. However, from clinical experience, if the patient experiences dyskinesia as a side effect of dopaminergic drugs, then speech performance may once again deteriorate.

The patient should be questioned as to his general fluctuation in functioning during the course of the day. Stable control is not necessarily maintained, despite regular medication. The appearance of the on-off reaction may cause marked fluctuation in speech functioning from hour to hour. Speech performance can be expected to deteriorate concomitant with a deterioration in the patient's general physical status.

Excess or deficiency of saliva in the mouth has an indirect effect on speech performance. The untreated patient, plus those not on anticholinergic medication, have a tendency to drooling and "slushy" articulation. This is believed to be due to reduced effectiveness and frequency of swallowing rather than any excess in saliva secretion.<sup>19</sup> The

majority of treated patients are placed on anticholinergic medication with the result that they complain of an abnormally dry mouth. This imparts a certain "thickness" of quality to the articulation. Almost without exception, patients with this problem report increased difficulty with articulation as saliva secretion diminishes. In this regard, the normal stress reaction of the patient to examination adds to an already existing problem.

#### Emotional Behaviour

Patients may also demonstrate a marked breakdown in performance as a result of stress. Anxiety and self-consciousness create physical tension which exacerbates the rigidity, tremor and movement disturbance. The patient's speech frequently deteriorates as soon as he faces the clinician and anticipates that his performance is to be assessed. It is necessary to ensure that the patient is relaxed and adjusted to the environment before attempting any assessment. Whilst the degree of breakdown under stress does afford valuable information in its own right, the clinician's primary aim is to obtain a rating of the patient's average functional speech ability. Many patients are subject to depression which results in a general lack of spontaneity of speech plus poor motivation to strive for optimal functioning. Anti-depressant drug therapy can alleviate the condition considerably, leading to an overall improvement in communicative behaviour.

#### Time of Assessment

Factors such as fatigue and dosage schedule of drugs may cause significant fluctuation of performance during the day. This applies especially to therapy with L-dopa where performance (ability) may diminish markedly as the effect of the drug wears off and the next dose falls due. Ideally, the patient should be interviewed at the same time of day for each subsequent assessment. This would in part help to control these factors. It is nevertheless essential to note the patient's physical and emotional state at the time of assessment.

#### Hearing

As onset of Parkinson's disease clusters around the middle years it follows that many patients will have some degree of presbyacutic hearing loss. The patient decompensates in his speech performance owing to a breakdown in his auditory monitoring skills. Speech dysfunction may consequently be the result of a double pathological process.

#### SPEECH SAMPLE AND ASSESSMENT TECHNIQUE

The Parkinson's disease speech rating scale is subject to the limitations of all rating scales. Qualitative, subjective judgements are required which suggests that some experience with Parkinson's disease speech is desirable in order to apply the scales most effectively. A rating scale of this nature cannot provide absolute quantitative values nor can it claim to

be equally efficient for the rating of all speech dimensions. Some dimensions remain inherently more difficult to evaluate than others.

An advantage of this type of scale for recording speech performance is that it focuses attention on each individual speech dimension. It is therefore possible to determine where the greatest changes occur as the disease progresses. Generalized statements, such as "disturbed rhythm", provide very little useful information when one is faced with a patient for re-assessment. However, if the clinician has available past ratings of the speed of speech, degree of akinesia, and perseveration of phonemes within a word, he consequently has a meaningful delineation of the manner in which the rhythm was previously judged as being disturbed. Recorded ratings are of particular reference value when a patient is assessed periodically over a number of years by several different clinicians.

Clinically, it is desirable that assessment of speech in the Parkinson's patient should be carried out on a spontaneous speech sample. As a rule, speech intelligibility is markedly more impaired in the spontaneous speech flow than it is in a restricted, formally induced sample. This discrepancy in performance has also been noted in the literature.<sup>5, 18</sup> As soon as one seeks to control the patient's speech output in any way, performance alters. An assessment made on a formally induced sample is therefore a poor reflection of the patient's functional speech ability.

A rating scale, as an assessment technique, is well suited for use with a spontaneous speech sample. The clinician engages the patient in conversation and waits until the patient has adjusted to the speaking situation before commencing the rating. The spontaneous sample also affords the clinician as much time as he requires in order to assess any single dimension. Provided that the clinician marks his ratings out of the patient's direct line of vision this assessment technique would seem to have a minimally disruptive effect on the patient and, consequently, his speech performance.

#### ADMINISTRATION OF THE RATING SCALE

The patient should be comfortably seated in a quiet room. The basic information required from the patient should be obtained before starting the assessment. The patient is engaged in conversation on a subject of interest after having been instructed to disregard the clinician's note taking. Once the patient has become adjusted to the speaking situation the clinician commences the speech assessment, discontinuing as necessary to maintain the patient in conversation. The clinician mentally focuses on each speech dimension placing a cross in the relevant place on the format. Recording of ratings should be done out of the patient's direct line of vision.

A gross clinical rating is required for each speech dimension. A rating of 0 denotes no impairment whilst 1, 2 and 3 denote mild, moderate and severe impairment respectively.

Assess maximum vocal intensity last as the patient is more likely to feel

confident and relaxed at this stage. Test by asking the patient to shout a word such as "help!" or "hullo" as loudly as possible. The rationale behind this test should be explained in order to elicit the patient's full cooperation. In spite of this, reliable results may not be obtained.

After the assessment has been completed, the patient should be asked to evaluate his performance in relation to his average speech performance over the previous few days. It may be helpful to obtain a similar evaluation from the spouse or other family member in order to confirm the reliability of the patient's subjective impression.

#### SPEECH DIMENSIONS

##### Articulation

Parkinson's disease is characterized by indistinct articulation. The complex disorder of muscle functioning results in irregular contraction of muscles and an inability to initiate the co-ordinated contraction of several muscles at any given time. There is a failure to move the articulators through the full excursion necessary for clear phoneme production. Alternatively, the patient may perform the articulatory movement adequately but fail to initiate phonation simultaneously. The indistinct articulation therefore reflects a failure to complete articulatory and phonatory movements correctly rather than the absence of movement.

Sarno<sup>18</sup> found that the type or degree of phonemic dysfunction does not necessarily correlate with limitations noted in movements of the oral musculature. Conversely, Canter,<sup>5</sup> investigated the relationship between diadochokinetic rate and articulation in Parkinson's subjects and found that diadochokinetic rates for both tongue tip and the back of the tongue correlated strongly with clarity of articulation. The correlation of lip diadochokinetic rate and articulation was slightly lower but still highly significant.

Standard single-word articulation tests are unsuitable for testing the Parkinson's patient. Research indicates that these patients usually perform normally on such tests despite the fact that they clearly have articulatory deficiencies in connected speech.<sup>5,9</sup>

Canter<sup>5</sup> evaluated the articulation in the context of connected speech and found that the majority of errors involved the plosives. These tended to be produced with a fricative quality and were at times omitted in final word position. Logemann et al<sup>13</sup> confirmed these findings and noted that errors of /v/ /ʃ/ and /ʒ/ resulted from reduced constriction of the air channel.

The indistinct articulation within connected speech in many patients with advanced disease makes it impossible to determine precisely which phonemes have been elided, distorted or omitted. In severe cases speech becomes unintelligible to the point where word junctures cannot be determined by the listener. The latter is unlikely to be entirely due to inadequate articulatory contacts. Factors such as low speech intensity, rapid speed of speech flow and akinesia contribute further to the listener's difficulty.

Rigidity of the jaw and associated facial muscles frequently result in poor projection of the articulated sound through the mouth. This lack of projection further confounds articulatory intelligibility and has led to a description of the speech as "swallowed" or "mumbled".

### Rate Of Speech

This is possibly the most variable feature of Parkinson's disease speech. Some writers have stressed the occurrence of slowed rate of speech whilst others have emphasized the abnormally rapid rate.<sup>3,6</sup> Canter<sup>3</sup> pointed out that many Parkinson's patients have a speech rate which falls within the normal range. Of 134 Parkinson's patients assessed clinically at the Johannesburg General Hospital, 44 (32,8%) were found to have some slowing of speech rate whilst 42 (31,4%) had an increase in their rate of speech. The remaining 48 (35,8%) patients fell within normal limits. Clearly, both slowed and increased rates occur as a result of a complex interaction of the many defects of muscle contraction produced by the disease. Each individual patient has a certain consistency in his overall rate of speech. As the disease progresses the fast speaker may become slower. However, the reverse is uncommon.

The term "propulsive rate" has been used to describe the abnormally fast rate of speech. It suggests the uncontrolled nature of the speech flow, similar to the propulsive gait, where the sequence of movement, once initiated, cannot readily be inhibited.

In severe cases of slowed rate of speech the patient can be seen to expend a great deal of effort in talking. The speech appears laboured, with difficulty in moving from one articulatory posture to the next. The patient frequently adapts to his difficulty by "editing" his speech, using only the minimum number of words necessary for communication.

### Akinesia Of Speech

Akinesia can be defined as the inability to change from one muscle contraction pattern to another, to initiate or maintain an action in the face of the necessity to change.

Akinesia, as it relates to speech, presents as an inability to initiate articulation and/or vocalization at the beginning of a speech segment or as a perseveration of an articulatory movement within a word or segment. The frustrated attempt to initiate speech may last several seconds. Once blocking of the speech musculature has been overcome, articulation frequently occurs propulsively over the ensuing speech segment. This segment may consist of several words, phrases or sentences. Abnormally long intervals occur between segments, reflecting the patient's inability to initiate each consecutive segment. These intersegmental intervals frequently appear inappropriately and not at the natural point within or at the end of a sentence. The intervals consist of a freezing or posturing of the articulators. The posturing may be either totally silent or else be accompanied by vocalization.

If the patient initiates vocalization successfully he generally sustains this until the blocking of the articulators is released for production of the intended utterance. The perseverative repetitions would appear to occur most commonly on phonemes or phoneme clusters in the initial word position, but can also be noted in the medial word positions. Perseveration of articulatory postures gives a stuttering type quality to the speech. Where speed of speech is also very rapid there can be cluttering with random omission of phonemes, syllables or even words.

Akinesia should not be confused with dyskinesia which occurs as a complication of dopaminergic medication. Dyskinesia presents as random choreaform movements of all muscle groups. Perioral dyskinesia is common. There is forced opening of the mouth with associated writhing and twisting of the tongue, lip, and cheek muscles whilst the patient is at rest. Movements may be inhibited to a certain extent during the actual speech act.

### Vocal Intensity

A subjective impression of overall reduced intensity is generally accepted as one of the earliest signs of speech disturbance in the Parkinson's disease patient despite laboratory research by Canter<sup>3,4</sup> indicating that there is no difference in average conversational intensity levels between Parkinson's patients and normals. Whilst he supports the fact that the speech of a Parkinson's patient is frequently perceived clinically as having inadequate intensity, he suggests that there must be parameters of speech loudness other than average intensity level which lead to this perception. Greene and Watson<sup>8</sup> have attributed the reduced vocal intensity to impaired respiratory movements which result in weak and fluctuating subglottic pressure.

The Parkinson's patient also demonstrates reduced voluntary vocal intensity at both ends of the intensity range.<sup>2,4</sup> There is an inability to phonate very loudly or very softly. The former appears to be due to rigidity of respiratory and laryngeal musculature whilst the latter reflects the failure to maintain the necessary balance between subglottic pressure and vocal fold tension required for very low intensity phonation.

Reduced intensity range can be tested by asking the patient to both whisper and to shout a word as loudly as possible. It is a difficult feature to rate clinically owing to the considerable individual variation in maximum intensity amongst normals as well as the patient's self-consciousness in producing his best attempt.

For these reasons the writer has not found it practical to attempt a fine clinical rating of intensity range, but rather to note whether the range appears to be within normal limits or is clearly outside the normal range.

### Speech Decay

Owing to the rigidity of the respiratory, laryngeal and oral musculature there is a tendency to weak or absent phonation and articulation at the end of speech segments. In advanced cases, where speech is slow and

laboured, speech decay may occur on the majority of words in the utterance. As the patient reduces effort, on approaching the end of a speech segment, the muscle rigidity prevents the fine control necessary to maintain phonation and firm articulatory contacts. Described subjectively, the word endings appear to "trail off" and become inaudible.

It would appear that maximum phonation times are reduced in the Parkinson's patient although not all researchers are in agreement.<sup>2,4,10</sup> Canter<sup>4</sup> found that his patients were able to produce a sustained vowel for less than half as long as normal controls. Speech decay, plus the poor phrasing of speech, may therefore be in part due to the inherent difficulty in sustaining phonation for an extended period of time.

### Vocal Quality

Rigidity and bradykinesia of the laryngeal musculature leads to incomplete adduction of the vocal folds. A hoarse, or harsh, breathy vocal quality is frequently the result. In some patients, this hoarse quality is constant and is superimposed on the entire speech flow whilst in others there is a random fluctuation between normal and hoarse quality. The latter case is due to continually alternating muscle tone and an inability to maintain the necessary fine motor co-ordination of the relevant muscle groups.

Previous research suggests that regular variability in intensity and/or frequency between adjacent vibratory cycles correlates well with perceptual judgements of vocal roughness or hoarseness.<sup>12,20</sup> Constant hoarseness should be distinguished from a fluctuating vocal quality which comprises episodes of hoarse speech interspersed with episodes of normal or near normal quality speech. The patient may present with either possibility at any given stage of his illness. As the disease progresses, the patient's vocal quality may change from fluctuating to constant hoarseness or vice versa. In advanced cases, the tendency is towards a constant forced hoarseness accompanied by marked speech decay. The Parkinson's patient is, in practice, rarely seen to be totally aphonic. In some patients the development of aphonia may be delayed or prevented by suitable medical treatment. The patient may resort to whispering as an avoidance of effort, but this does not reflect his true phonatory potential.

### Prosody

Dysprosody, or monotonous speech, relates to a lack of control over the stress and inflection variations natural to normal speech. It has been suggested that emphasis on stressed syllables and key words is reduced in Parkinson's disease.<sup>7</sup> Dysprosody, together with reduced vocal intensity are frequently the earliest speech signs of Parkinson's disease to be observed clinically.

Research indicates a lack of agreement as to the precise origin of the subjective impression of monotony. Canter<sup>3</sup> reports that reduced intensity

variability (cf. stress) was not a feature of his Parkinson's patients as compared to normals. He concluded that reduced use of stress is not responsible for the clinical impression of monotony and postulates that the reduced pitch range (cf. inflection) is at least partly responsible.

Dysprosody may not be entirely due to dysfunction of the peripheral speech mechanism. Peacher<sup>16</sup> thought that it reflected both central and peripheral disorders, whilst Monrad-Krohn<sup>14</sup> considered it to be a central language disorder which impairs the melodic variations of speech. Darley et al<sup>7</sup> suggested that restricted range of movement was the most likely cause of the prosodic insufficiency. On clinical assessment, the patient's immobile face may well add psychological weight to the subjective impression of monotonous speech.

### Pitch

The Parkinson's patient may demonstrate a significantly higher modal pitch than normals, i.e. there is an increase in the average pitch level over the entire speech flow. Subjectively, the patient appears to be speaking at a somewhat higher pitch than normal, quite apart from prosodic features which may or may not be intact. Sarno<sup>18</sup> and Morley<sup>15</sup> noted this trend as a result of perceptual evaluations. Canter<sup>3</sup> confirmed this clinical finding using frequency analysis. His patient group had a median fundamental vocal frequency of 129 Hz on the average, whilst the median for the normal controls was 106 Hz.

Clinically, an increased modal pitch is a difficult feature to assess. It can be identified far more readily in the male patient than in the female. This is due to the fact that there is a far greater permissible range for high modal pitch levels in the female than in the male. The phenomenon is probably attributable to a fairly constant rigidity of the entire laryngeal musculature.

### PARKINSON'S DISEASE SPEECH RATING SCALE

#### EMOTIONAL BEHAVIOUR

Congruent	Confused	Lethargic
Depressed	Euphoric	Labile
Anxious	Unco-operative	
Other		

#### HEARING

#### SALIVA IN MOUTH

Excessive	Normal	Reduced
Effect on speech		

#### PATIENT'S RATING OF:

(a) Fatigue Level		
Marked	Moderate	Minimal
(b) Physical Status		
Above Average	Average	Below Average

*CURRENT MEDICATION* .....  
*TIME OF ASSESSMENT* ..... *TIME OF LAST DOSAGE* .....  
*NOTES* .....

**A. ARTICULATION**

- 0 – no impairment.
- 1 – mild impairment of articulation. Occasional indistinct plosives.
- 2 – moderate impairment. Some distortion of fricatives. Plosives frequently indistinct.
- 3 – severe distortion of fricatives with multiple indistinct or omitted plosives. Difficulty in detecting word junctures.

**B. RATE OF SPEECH**

- 0 – no impairment.
- (i) Fast Speech:
  - 1 – slight increase in rate.
  - 2 – speech flow moderately fast.
  - 3 – speech flow rapid.

OR

- (ii) Slow Speech:
  - 1 – slight decrease in rate.
  - 2 – moderate slowing of speech flow.
  - 3 – marked slowing of speech flow. Speech laboured.

**C. AKINESIA OF SPEECH**

- (i) Initiation of Segments:
  - 0 – no impairment.
  - 1 – occasional difficulty in initiating articulation and/or vocalization. Slight lengthening of intersegmental intervals.
  - 2 – frequent difficulty in initiating articulation and/or vocalization. Silent posturing of articulators observable plus longer intersegmental intervals.
  - 3 – severe difficulty in initiating vocalization and/or articulation. Silent posturing results in lengthy intervals between speech segments.
- (ii) Perseveration:
  - 0 – no impairment.
  - 1 – occasional single repetition of phonemes and/or phoneme clusters.
  - 2 – frequent repetition of phonemes and phoneme clusters within a word. Perseverations consist of one or two repetitions.
  - 3 – severe perseveration of phonemes and phoneme clusters. Repetitions are varied and lengthy.

D. *INTENSITY*

- 0 – no impairment.
- 1 – overall speech intensity slightly reduced.
- 2 – overall intensity moderately below the normal range. Weak vocalization still audible.
- 3 – speech aphonic.

E. *SPEECH DECAY*

- 0 – no impairment.
- 1 – mild decay of vocal intensity and articulatory contact at the end of speech segments.
- 2 – moderate reduction in vocal intensity and articulatory contact at the end of segments.
- 3 – speech decay severe. Word endings frequently unintelligible owing to poor articulatory contact. Weak/absent vocalization.

F. *VOCAL QUALITY*

- 0 – no impairment.
- (i) Constant:
  - 1 – slightly hoarse quality superimposed on entire speech flow.
  - 2 – moderate hoarse quality.
  - 3 – forced, hoarse quality. Visible effort expended in vocalizing.

OR

- (ii) Fluctuating:
  - 1 – occasional fluctuation in vocal fold quality resulting in moments of hoarse quality interspersed in a speech flow of normal vocal quality.
  - 2 – approximately 50% of the speech flow is produced with normal quality. Hoarse quality interspersed randomly over words, phrases or sentences.
  - 3 – hoarse quality predominates, but moments of normal vocal quality are still detectable in the speech flow.

G. *PROSODY*

- 0 – no impairment.
- 1 – slight dysprosody. Speech slightly monotonous.
- 2 – speech monotony pronounced, but some use of stress and inflection still evident.
- 3 – severe dysprosody. Speech produced in a flat, unvarying monotone.

H. *PITCH*

- 0 — no impairment.
- 1 — modal vocal pitch slightly above the normal range.
- 2 — moderately raised modal pitch.
- 3 — marked rise in modal pitch.

*MAXIMUM VOCAL INTENSITY*

Within normal limits	Reduced	Unreliable
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*OTHER*

*RATING OF SPEECH ASSESSMENT SAMPLE*

By Patient:

Below average	Average	Above average
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By Family Member:

Below Average	Average	Above average
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**MOULDS:**

Soft, hard, skeleton, vented, occluded etc.

**REPAIRS:**

All aids supplied with a scientific performance report after repair.

**SPECIAL PRICES for Dealers and Institutions.**

**ACCESSORIES:**

Teacher – pupil, parent – child, individual Audiotainers, very reasonably priced.

Group Audio Trainers.

TV – Wireless infrared Transistor Receiver sets made by SENNHEISER.

Audiometers: Screening, Diagnostic, Research, ERA and Electrocochleography  
C.O.R. and Peep Show.

Impedance bridges.

Manufacturers of Sound proof booth and sound proof rooms.

Hearing Aid testing set by "Fonix" U.S.A.

Phonak noise generator with different frequencies, pure tone and warble tone,  
for everyday's use.

We repair and calibrate Audiometers.

Sound level meters, calibrators.

Industrial noise consultants.