

## Development of Guideline for Rating the Physical Impairment of Otolaryngologic Field

We develop a guideline for rating the physical impairment of otolaryngologic fields. Assessment of hearing disturbance and tinnitus required physical examination, pure tone audiometry, speech audiometry, impedance audiometry, brainstem evoked response audiometry, Bekesy audiometry, otoacoustic emission test, and imaging examination. History taking, physical examination, and radiological examination for the vestibular organ and brain, righting reflex test, electronystagmography, and caloric test are taken for evaluation of balance disorder. Olfactory function tests include University of Pennsylvania Smell Identification test, Connecticut Chemosensory Clinical Research Center test, T and T olfactometry and Korean Version of Sniffin's Sticks test. Medical history and physical examination is mandatory to evaluate severity of respiration difficulty. Examinations include flexible fiberoptic nasopharyngoscope, bronchoscopy, simple soft-tissue radiography films of upper airway and high resolution computed tomography. Evaluation of mastication and swallowing are history taking, physical examination, examination for upper jaw, lower jaw, and temporomandibular joint, dental examination and radiological studies. Endoscopy and esophagography are also needed. Voice disorder is evaluated based on physical examination, oral pharynx and larynx endoscopy, larynx stroboscopy, hearing assessment, laryngeal electromyography, sound analysis test, aerodynamic test, electroglottography, and radiologic examination. Articulation disorder is assessed by picture consonant articulation test. These are position articulation test, Lee-Kim Korean articulation picture and speech intelligibility assessment.

Key Words : Hearing; Vestibule; Smell; Respiration; Voice; Mastication; Deglutition

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## INTRODUCTION

Otolaryngologic fields (ear, nose, throat, and related structures) are a division of the special senses, and there are impairments of hearing, equilibrium, olfaction, respiration, mastication, deglutition, voice, and speech. Because physical impairments of special senses in otolaryngologic field are subjective, evaluation of physical impairments of special senses in otolaryngologic field is difficult. So we need to make objective standards of physical impairment on the basis of objective clinical data. We accordingly develop a guideline for rating the physical impairment of otolaryngologic fields.

## RESULTS

### Hearing impairment

The impairment of hearing disturbance and tinnitus should be assessed by specialists of the otorhinolaryngology in medical institutions equipped with specific instruments. When

assessing the impairment, the specialists should first check medical records, certificates and others to show that there is no improvement in the severity of disorders even after a medical treatment of more than 6 months. In the case of possible recovery, the impairment assessment should be held back after medical treatment (1-3).

Required clinical tests are as follows: physical examination, pure tone audiometry, speech audiometry and impedance audiometry. As subsidiary tests, there are brainstem evoked response audiometry (ABR), Bekesy audiometry, otoacoustic emission test, and imaging examinations (2, 3).

The results from the pure tone audiometry are the most important in judging the severity of impairment. In addition, other objective methods of audiometry should be supplemented for ensuring the reliability of the test. The pure tone audiometry for hearing disturbance assessment is conducted at the frequencies of 500, 1,000, 2,000, 3,000, 4,000, and 8,000 Hz, and is carried out about three times, once per three to seven days interval (3).

With the pure tone audiogram test results, hearing disturbance is assessed, based on the air conduction pure tone aver-

age, according to the six division method ( $a+2b+2c+d/6$ , 500 Hz [a], 1,000 Hz [b], 2,000 Hz [c], 4,000 Hz [d]). Not considering the places below the decimal point, in the cases when the auditory threshold in the assigned frequency is above 100 dB or out of the scope of an audiometer, it is regarded to be 100 dB. In the cases when it is below 0 dB, it is regarded to be 0 dB (3, 4).

Having tinnitus with hearing disturbance may lead to the damage of speech discrimination, which can deteriorate the capability of discriminating language. When there is clear and constant tinnitus, which influences the performance of everyday activities and repeated tests show the sound of similar quality and loudness, up to 5% is added to the function impairment (3, 4).

The average hearing acuity of both ears, which is drawn from the test above, is divided into a poorer ear (an ear with worse hearing) and a better ear (an ear with better hearing) in order to assess the impairment. No response indicates an absolute hearing loss, caused by the defective air conduction and bone conduction, and they do not make any response even to the maximum sound pressure of a normal pure tone audiometer. The hearing of above 91 dB means no ability of hearing except for the bone conduction, or the auditory threshold of above 91 dB at the pure tone audiometry. The functional impairment rate is to assess the severity of disorders by the auditory threshold of both ears, by regarding both ears showing no response as 100% hearing loss (Table 1) (4-7).

### Balance disorder (Disequilibrium, Vertigo)

Equilibrium sense provides an input to the positions of our own bodies and the sense of direction in space (8). It is maintained by visual system, the proprioceptive system and vestibular organ. As balance disorder can be generated by the disorder of other organs like nervous system, cardiovascular system or visual system, this study deals with the balance disorder produced only by the vestibular disorder (8-10). As the vestibular disorder responds sensitively, the impairment examination should be taken after the illness becomes stable, and the symptoms or signs of impairment should be shown with supportive objective finding (9-11). Furthermore, the examination should consider the functions that are needed in normal activities of examinee. The impairment examination on the equilibrium sense should be taken after making sure by checking medical records and diagnosis that the symptoms continue to be stable even after more than 1 yr of medical treatment by otorhinolaryngologist in specialized medical facilities (8, 9).

History taking, physical examination and radiological examination for the vestibular organ and brain are taken for evaluation. To evaluate the vestibular function, righting reflex test, electronystagmography and caloric test are also taken. When the objectivity of examination is needed, rotatory chair test and posturography can also be used (9-11).

The scale of the balance disorder is determined by the table shown below, which encompasses laboratory finding, treatment history and functional impairment finding (Table 2, 3).

### Olfactory disturbance

Olfactory loss or distortion should be evaluated by otolaryngologist with modern means for accurately and objectively

**Table 1.** Functional impairment scale according to both ear hearing threshold

Both ear hearing threshold		Functional impairment (%)
Poorer ear (dB)	Better ear (dB)	
No response	No response	100
No response	91-	95
91-	91-	90
No response	81-90	87.5
91-	81-90	85
81-90	81-90	82.5
No response	71-80	77.5
91-	71-80	75
81-90	71-80	72.5
71-80	71-80	70
No response	61-70	65
91-	61-70	62.5
81-90	61-70	60
71-80	61-70	57.5
61-70	61-70	55
No response	51-60	50
91-	51-60	47.5
81-90	51-60	45
71-80	51-60	42.5
61-70	51-60	40
No response	41-50	40
51-60	51-60	37.5
91-	41-50	37.5
81-90	41-50	35
71-80	41-50	30
61-70	41-50	27.5
No response	27-40	27.5
51-60	41-50	25
91-	27-40	25
41-50	41-50	22.5
81-90	27-40	22.5
71-80	27-40	20
No response	0-26	17.5
61-70	27-40	17.5
91-	0-26	16.5
51-60	27-40	15
81-90	0-26	15
41-50	27-40	13
27-40	27-40	12
71-80	0-26	11
61-70	0-26	9
51-60	0-26	6
41-50	0-26	5
27-40	0-26	3

**Table 2.** Functional impairment scale according to degree of dysequilibrium

Grade	Impairment (%)	Impairment scale
1	0-20	Symptoms or signs of vestibular balance disorder are shown with supportive objective findings Someone who can perform normal daily activities for oneself excluding any complicated or critical works, and who gets mark 7-10 from three examination results (Table 3)
2	21-40	Symptoms or signs of vestibular balance disorder are shown with supportive objective findings Someone who can perform only easy and simple daily activities for oneself, and who gets mark 11-14 from three examination results (Table 3)
3	41-70	Symptoms or signs of vestibular balance disorder are shown with supportive objective findings Someone who cannot perform normal activities excluding taking care for oneself and ambulation, and who gets mark 15-18 from three examination results (Table 3)
4	71-99	Symptoms or signs of vestibular balance disorder are shown with supportive objective findings Someone who cannot perform every normal activities including taking care for oneself and ambulation, and who gets mark more than 19 from three examination results (Table 3)

**Table 3.** Three examinations for functional impairment scale of the balance disorder

A. Laboratory finding: maximum mark: 7

Test	Symptoms	Mark
Caloric test, rotatory chair test	Bilateral vestibular function defect	7
Caloric test, rotatory chair test	Bilateral vestibular function weakness	5
Caloric test, rotatory chair test	Unilateral vestibular function defect	2

B. Treatment history: maximum mark: 3, within recent 1 yr

Division	Mark
Periodic treatment (more than 12 times in a year)	3
Treatment in a long period (more than 6 times periodically in a year)	2
Treatment in a short period (more than 6 times in six months)	1

C. Functional impairment finding: maximum mark: 10

Division	Mark
Hard to stand up with eyes closed or fall down while walking 10 m of straight line with eyes open (6 m of distance can be applied when it is hard clinically)	10
Stop to regain balance while walking 10 m of straight line with eyes open (6 m of distance can be applied when it is hard clinically)	6
Get off the center line more than 60 cm while walking 10 m of straight line with eyes open (6 m of distance can be applied when it is hard clinically)	4

assessing olfactory function, including means for detecting malingering (12).

Olfactory perception results from a cascade of events beginning with the arrival of airborne odorant molecules at the olfactory mucosa, and ending in physiological and psychological effects, defining a response to these stimuli. The olfactory receptor cells is a bipolar neuron whose distal process carries cilia, which project into the nasal cavity. These cilia respond to a chemical stimuli by interactions between odorant molecules and receptor proteins on its surface. The proximal nonmyelinated axons form the olfactory nerve, which traverses from the foramina in the cribriform plate to synapse in the olfactory bulb (12).

Anosmia refers to loss of the ability to smell, whereas hyposmia refers to decreased ability to smell. Olfactory dysfunction

can be either bilateral or unilateral. Parosmia is distorted or perverted smell perception. Distortion of the sense of smell may bother patients more than the loss of the sense of smell. A problem often encountered in testing olfactory sensitivity is that many patients confuse the loss of the sense of smell with the loss of the sense of taste. Thus, a clear diagnostic distinction should be made between a true taste disorder and an olfactory disorder.

The evaluation of patients with olfactory dysfunction must involve a careful medical history, paying special attention to antecedent events that might be related to the onset of olfactory loss, such as upper respiratory infections, head trauma, nasal surgery, nasal and paranasal sinus disease, and exposure to environmental chemicals.

Essential components of the physical examination include

a complete otolaryngologic examination with an emphasis on anterior rhinoscopy and nasal endoscopy, allowing for a thorough assessment of the olfactory cleft. High-resolution computed tomography (HRCT) appears to be the most useful and cost-effective screening tool to assess sinonasal diseases, while magnetic resonance imaging (MRI) is the technique of choice to evaluate the olfactory bulbs, olfactory tracts, and intracranial causes of olfactory dysfunction. In rare instances, biopsies of the olfactory mucosa can be obtained to assess the status of the olfactory epithelium (12, 13).

Olfactory function tests are essential to establish the validity of a patient's complaint, characterize the specific nature of the problem, reliably monitor changes in function over time, detect malingering, and establish compensation for permanent disability. They include University of Pennsylvania Smell Identification Test (UPSIT), Connecticut Chemosensory Clinical Research Center test (CCCRC), T and T olfactometry and Korean Version of Sniffin's Sticks (KVSS) test (12-14).

Despite the fact that a wide range of psychophysical olfactory tests are available for assessing olfactory function, most are of unknown reliability and validity, thus suffering due to lack of normative data. In UPSIT, normosmia scores are over 34, hyposmia scores 18-33, and anosmia scores less than 18. In 1-butanol threshold test, normal subjects score over 6, hyposmia subjects score 2-5, and anosmia subjects score 1 or 0. In olfactory threshold test by T&T olfactometer, the average recognition threshold is more than 5 in anosmic and 1.1-5 in hyposmic, while less than 1.0 in normal subjects. In KVSS test, Threshold, discrimination, identification (T.D.I.) score is over 31 in normosmic, 15-30 in hyposmic, and less than 15 in anosmic (12, 15).

Malingering sometimes occurs in patients seeking insurance settlements. Malingering is suspected if a patient denies any sensation when the patient is tested with trigeminal stimuli, such as ammonia, acetic acid or menthol. On forced choice psychophysical tests, such as the UPSIT and KVSS, malingering appears with the report of lower scores than expected on the basis of chance (25%) (15, 16).

Criteria for evaluating functional impairment in accordance with the degree of olfactory disturbance are those listed in Table 4.

### Respiration difficulty

Respiration may be defined as the act or function of breathing, that is, the act by which air is inspired and expired from

**Table 4.** Functional impairment scale according to degree of olfaction

	Functional impairment (%)
Normal	0
Hyposmia	30
Anosmia	100

the lungs. The respiratory system includes the lungs and the air passages; the latter includes the anterior nares, nasal cavities, oral cavity, nasopharynx, oropharynx, hypopharynx, larynx, trachea, and bronchi. Respiratory difficulty can be caused by diseases of the lung parenchyma or defects of the airways. In this proposed guideline, discussion of permanent impairments related to respiration is limited to defects of the air passages (17).

The most commonly encountered defect of air passages is obstruction, which may be partial (stenosis), or complete (occlusion). In patients with airway obstruction, dyspnea is a cardinal symptom that contributes to a patient's diminished capacity to carry out activities of daily living and to permanent impairment. Dyspnea is noted first and is most severe during exercise. However, when dyspnea occurs at rest, respiratory dysfunction is most likely severe. Dyspnea may be accompanied by related symptoms and signs such as voice change, swallowing difficulty, cough, and wheezing.

A complete medical history is important, with specific attention directed toward a history of causative or predisposing disease. Questions about the severity of dyspnea during exercise or at rest should be elicited. Other symptoms associated with dyspnea should also be obtained (17-19).

A thorough physical examination is mandatory to evaluate the severity of upper airway obstruction. Chest auscultation may reveal wheezes. The sternal notch and midline neck are examined for evidence of retraction. Obstruction below the thoracic inlet does not cause suprasternal retraction. Endoscopy is the definite diagnostic examination of the upper airway. The examination includes nasopharyngoscopy with a flexible fiberoptic nasopharyngoscope, which is used to assess the airway spanning from the anterior nares to the level of vocal cords. Bronchoscopy can also be performed when the trachea and bronchi are evaluated. Patients with tracheostomy should be evaluated to check whether adequate respiration is possible when the tracheostomy tube is plugged (17).

Anteroposterior and lateral soft-tissue radiography films of the upper airway are often used as screening test for patients with upper airway compromise. HRCT has become an invaluable aid in the evaluation of upper airway, while MRI is very useful for tracheal and laryngeal imaging, which is best performed in the coronal and sagittal planes (17).

The site and character of obstructive airway lesions may be determined by pulmonary function tests with flow-volume loops. Objective measures for the voice may also be needed in patients with abnormal voice.

Patients with upper airway defects may be evaluated in accordance with the classification in Table 5 (19).

Criteria for evaluating functional impairment in accordance with the degree of airway defects are those listed in Table 6.

### Mastication and swallowing difficulty

Mastication and swallowing are essential functions when

**Table 5.** Classification of airway defects

Class I	Clinical manifestation	Dyspnea does not occur at rest Dyspnea is not produced by walking, climbing stairs, performance of other usual activities of daily living, stress, prolonged exertion, hurrying, hill climbing, recreation requiring intensive effort, or similar activity
	Examination	Examination reveals one or more of the following: Partial obstruction of oropharynx, hypopharynx, larynx, upper trachea, lower trachea, or bronchi Complete obstruction of the nose (bilateral) or nasopharynx
Class II	Clinical manifestation	Dyspnea does not occur at rest Dyspnea is not produced by walking freely on the level, climbing at least one flight of ordinary stairs, or the performance of other usual activities of daily living
	Examination	Dyspnea is produced by stress, prolonged exertion, hurrying, hill climbing, recreation, or similar activity Examination reveals one or more of the following: Partial obstruction of oropharynx, hypopharynx, larynx, upper trachea, lower trachea, or bronchi Complete obstruction of the nose (bilateral) or nasopharynx
Class III	Clinical manifestation	Dyspnea does not occur at rest Dyspnea is produced by walking more than one or two blocks on the level or climbing one flight of ordinary stairs even with periods of rest, performance of other usual activities of daily living, stress, hurrying, hill climbing, recreation, or similar activity
	Examination	Examination reveals one or more of the following: Partial obstruction of oropharynx, hypopharynx, larynx, upper trachea, lower trachea, or bronchi
Class IV	Clinical manifestation	Dyspnea does not occur at rest, although patients is not necessarily bedridden Dyspnea is aggravated by the performance of any of the usual activities of daily living beyond personal cleansing, dressing, grooming or its equivalent
	Examination	Examination reveals one or more of the following: Partial obstruction of oropharynx, hypopharynx, larynx, upper trachea, lower trachea, or bronchi
Class V	Clinical manifestation	Severe dyspnea occurs at rest, spontaneous respiration is inadequate Respiratory ventilation is required
	Examination	Examination shows partial obstruction of oropharynx, hypopharynx, larynx, upper trachea, lower trachea, or bronchi

**Table 6.** Functional impairment scale according to degree of respiration difficulty

Class	Functional impairment (%)
I	0-10
II	11-30
III	31-50
IV	51-90
V	90-

\*, Patients with successful permanent tracheostomy should be rated at 25% impairment of the whole person.

eating food. A disorder of jaw joint, malocclusion, and tongue illness can cause mastication difficulty. Moreover, esophageal stenosis, tongue illness, and the paralysis of nervous system of pharynx and larynx can cause the swallowing difficulty. When a disorder is generated in the mastication and swallowing function, limitation in eating is inevitable, and thus, becomes the most objective standard to judge the impairment of mastication and swallowing function. Impairment evaluation is taken when the symptoms do not get better and become fixed even with constant treatment of over 1 yr. If doctors foresee improvement in symptoms, reexamination should be taken 2 yr after the final examination. When examining mastication and swallowing function, doctors should see the medical record, operation record, and medical certifi-

cate, and should get consultation from dentists if necessary. Evaluation should be taken when the eating ability is stable and the rehabilitation is maximized (20).

The required clinical tests are as follows: history taking, physical examination, examination for upper jaw, lower jaw and temporomandibular joint, dental examination and radiological studies. Endoscopy and esophagography are needed to examine the condition of pharynx and larynx and esophageal obstruction. The scale of impairment is determined according to Table 7.

### Voice disorder

Voice disorder refers to an impairment of sound produced by the vocal cord, where there is an abnormality in one of the 3 elements of phonation: intensity (abnormal intensity), pitch (abnormal control), and quality (abnormal quality), which blocks communication. This term is used when objective and medical diagnosis has been made, and the diagnosis of impairment is made only when it is considered permanent after effective treatment of the causative disease. The appropriate timing for the assessment differs depending on the causative disease, and it is done either at the onset or at least 6 months of treatment after surgery. One of the exception to this rule is total laryngectomy, where the diagnosis

**Table 7.** Functional impairment scale according to degree of mastication and swallowing difficulty

Grade	Rate (%)	Impairment scale
1	1-20	Mild functional impairment in mastication system (losses of tongue more than 1/3, Dental Prosthesis due to the losses of all teeth, possible mouth opening of 10-30 mm) Someone who can eat moderate solid diet like rice and bread, but has certain limit in biting and grinding function
2	21-40	Moderate functional impairment in mastication system (possible mouth opening of less than 10 mm) Diet is limited to semisolid or soft foods due to the esophageal obstruction Dysphagia with choking on liquid or soft foods, but diet is eliminated spontaneously
3	41-70	Diet is limited to water or liquid foods due to esophageal obstruction Dysphagia with nasal regurgitation and aspiration of liquids or semisolid foods and it needs mechanical suction
4	71-99	Ingestion of food requires tube feeding or gastrostomy due to the paralysis of tongue, pharynx and larynx or complete esophageal obstruction Severe inability to swallow or handle oral secretions without choking, with need for assistance and suctioning

**Table 8.** Classification of voice impairment

Classification	
Mild impairment	Mild loss of phonation function when the impairment does not affect sound intensity, pitch or quality of daily life. Near-distance and everyday life conversation is possible, but sound intensity, pitch or quality appropriate for professional life cannot be achieved Rate of functional impairment 0-14% Example> vocal nodule in a singer
Moderate impairment	Somewhat serious impairment of phonation when one can generate adequate sound intensity, pitch and quality for everyday life which enables near-distance and daily life conversations, but there is an impairment in special situations like noisy environments or there are impairments in generating sound intensity, pitch and quality Rate of functional impairment 15-34% Example> sulcus vocalis (In noisy environment, one can produce loud intensity but cannot sustain enough tone or quality)
Moderate to severe impairment	Serious loss of phonation when one can generate adequate sound intensity, pitch, and quality for everyday life so that the near-distance conversation is possible, but ability to manage and sustain conversations for social activity are impaired Rate of functional impairment 35-59% Example> bilateral vocal paralysis (where severe breathiness and blocks the ability to produce appropriate intensity. There is also some deficit in sound pitch and quality), spasmodic dysphonia, sulcus vocalis
Severe impairment	Very serious loss of phonation when one can produce vocal sound but only limited sound intensity, pitch and quality for everyday life and when near-distance conversations are hard to convey Rate of functional impairment 60-84% Example> severe leukoplakia, partial laryngectomy status due to malignancy such as laryngeal cancer, hypopharyngeal cancer, and trauma to larynx
Most severe impairment	Complete or permanent loss of phonation when one can not produce any vocal sounds or when one can produce some vocal sound however, one can not produce adequate sound intensity, pitch, and quality for daily life Rate of functional impairment 85-100% Example> Total laryngectomy status (including some cases where rehabilitative methods such as artificial larynx and esophageal voice is possible) Complete stenosis of larynx due to tracheostomy or tracheostoma status

can be made immediately after surgery. Vocal function can be divided into near-distance vocal function and daily vocal function. The near-distance function is the ability to communicate with family members or the care-giver to carry out basic daily life and can be assessed by having patient read a few sentences and asking a few questions within 1.5 m distance. Daily life vocal function is the ability to adequately manage and communicate in the vocational-social life.

Voice disorder is easier to diagnosis and is more objective when using the guidelines based on anatomical loss or de-

rangements, but it does not necessarily correlate with the actual function. However when using the guidelines based on the function, it has limitations in that it requires the examinees to actively participate, and such cooperation is inevitable. The same diagnosis holds many levels of impairment and it is difficult to find an objective means of the rating (21).

Currently, there is no single objective method available to measure the rate of voice disorder, therefore, we measure it with various methods. The compulsory tests used include physical, oral, pharynx, and larynx endoscopic examination,

**Table 9.** Functional impairment scale according to degree of voice disorder

	Functional impairment (%)
Mild	0-14
Moderate	15-34
Moderate to severe	35-59
Severe	60-84
Most severe	85-100

**Table 11.** Functional impairment scale according to degree of articulation difficulty

	Functional impairment (%)
Mild	0-14
Moderate	15-34
Moderate to severe	35-59
Severe	60-84
Most severe	85-100

**Table 10.** Classification of articulation impairment

Classification	
Mild impairment	Mild loss of articulation function. Able to articulate most of everyday words Consonant accuracy is above 76%, but intelligibility is less than 75% Rate of functional impairment 0-14%
Moderate impairment	Somewhat serious impairment of articulation function when one can articulate appropriate words for daily conversation Consonant accuracy 61-75% Stuttering in which the fluency of language is impaired by 12-40% Rate of functional impairment 15-34%
Moderate to severe impairment	Serious loss of articulation ability when one can articulate few words for daily conversation Consonant accuracy 31-60% Stuttering in which the fluency of language is impaired by 41-77% Rate of functional impairment 35-59%
Severe impairment	Very serious loss of articulation ability when one can articulate only a few words of daily conversation Consonant accuracy 11-30% Stuttering in which the fluency of language is impaired by 78-96% Rate of functional impairment 60-84%
Most severe impairment	Complete or permanent loss of articulation in which one cannot articulate any words for everyday conversation Consonant accuracy 0-10% Stuttering in which the fluency of language is impaired by more than 97% Rate of functional impairment 80-100%

larynx stroboscopy, and hearing assessment by a speech-language pathologist, and some of the supplementary tests include laryngeal electromyography, computerized sound analysis test, aerodynamic test, electrolottography, and radiologic examinations (CT and MRI) (Table 8, 9).

### Articulation impairment

Articulation means using organs of phonation to communicate with others in everyday sense, therefore, articulation difficulty refers to the limitation of communication using spoken language. It is limited to the cases in which objective and medical methods have been used in diagnosis, and in cases of aphasia due to the destruction of language center in the central nervous system, and language development disorder in developing age eliminated. Thus, articulation difficulty in broad terms can be made by consulting neurology, rehabilitative medicine, pediatrics, and psychology department. Rating of voice disorder and articulation difficulty should be done separately, and the higher degree of impairment between the two is used as a principle.

Various objective methods are used for assessment, and

every assessment should be made by a speech language pathologist. In clinical sense, fluency disorder can be assessed by paradise-fluency assessment (P-FA) and stuttering severity instrument (SSI). Articulation disorder is assessed by Picture consonant articulation test (PCAT). There are position articulation test, Lee-Kim Korean articulation picture (KAP), and speech intelligibility assessment.

In making the diagnosis of articulation disorder, language analysis should be made on the patient's major speech problems. In such a case, pronunciation test should be done to assess the consonant accuracy. If it is above 76%, speech intelligibility test should be made to rate the impairment (Table 10, 11).

## DISCUSSION

In impairment of hearing disturbance and tinnitus, previous guideline for rating the hearing impairment (the State Tort Liability Act) was made based on condition of tympanic membrane and subjective hearing ability according to distance. Previous guideline divided hearing impairment into

six degrees (20%, 30%, 40%, 60%, 70%, and 90%). We developed more objective guideline for hearing disturbance based on pure tone audiometer. We can rate hearing impairment precisely by checking hearing ability of better and worse ear.

In impairment of balance, previous guideline for rating the balance impairment (the State Tort Liability Act) was made based on degree of working disability due to disturbance of neurologic function. Previous guideline divided balance impairment into two degrees (40% and 60%). We developed more objective guideline for balance impairment based on laboratory findings (righting reflex test, electronystagmography, caloric test, rotatory chair test, and posturography), treatment history and functional impairment findings.

In impairment of olfaction and respiration, previous guideline for rating the olfactory and respiratory impairment (the State Tort Liability Act) was made based on physical finding such as nasal deformity and degree of neurologic symptom. Previous guideline divided olfactory and respiratory impairment into three degrees (5%, 15%, and 40%). We developed more objective guideline for olfactory and respiratory impairment based on clinical manifestation and laboratory findings (UPSIT, CCCRC, KVSS, flexible fiberoptic nasopharyngoscope, bronchoscopy, simple soft-tissue radiography films of upper airway and HRCT). In new guideline, we considered anatomical state of upper and lower respiratory tract. So we can more precisely rate respiratory impairment.

In impairment of mastication and swallowing, previous guideline for rating the mastication and swallowing impairment (the State Tort Liability Act) was made based on subjective mastication and swallowing function of patient. Previous guideline divided olfactory and respiratory impairment into seven degrees (5%, 15%, 30%, 40%, 70%, 90%, and 100%). We developed more objective guideline for mastication and swallowing impairment based on history taking, physical examination, examination for upper jaw, lower jaw and temporomandibular joint, dental examination and radiological studies. Endoscopy and esophagography are used to examine the condition of pharynx and larynx and esophageal obstruction. In new guideline, we considered anatomical state of digestive tract. So we can more precisely rate mastication and swallowing impairment.

In impairment of voice, previous guideline for rating the voice impairment (the State Tort Liability Act) was made based on subjective phonation function of patient. Previous guideline divided voice impairment into seven degrees (5%, 15%, 30%, 40%, 70%, 90%, and 100%). We developed more objective guideline for voice impairment based on history taking, oral, pharynx, and larynx endoscopic examination, larynx stroboscopy, hearing assessment. We can use supplementary tests such as laryngeal electromyography, computerized sound analysis test, aerodynamic test, electroglottography, and radiologic test (CT and MRI). In new guideline, we considered anatomical state of phonation system. So

we can more precisely rate voice impairment.

In impairment of articulation, previous guideline for rating the articulation impairment (the State Tort Liability Act) was made based on subjective articulation function of patient. Previous guideline divided articulation impairment into seven degrees (5%, 15%, 30%, 40%, 70%, 90%, and 100%). We developed more objective guideline for articulation impairment based on history taking, physical examination, fluency test by P-FA and SSI, articulation test by PCAT, position articulation test, KAP, and speech intelligibility assessment. We consider consonant accuracy and stuttering when we rate articulation impairment. In the new guideline, we consider anatomical and functional state of articulation system. So we can more precisely rate mastication and articulation impairment.

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