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, 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

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
Development of Guideline for Rating the Physical Impairment of Otolaryngologic Field

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).

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

| Poorer ear (dB) | Better ear (dB) | Functional impairment (%) |
|----------------|-----------------|----------------------------|
| 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                         |
| 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                       |
| 91             | 27-40           | 25                         |
| 81-90          | 27-40           | 22.5                       |
| 71-80          | 27-40           | 20                         |
| No response    | 0-26            | 17.5                       |
| 91             | 27-40           | 17.5                       |
| 81-90          | 0-26            | 16.5                       |
| 71-80          | 27-40           | 15                         |
| 61-70          | 0-26            | 15                         |
| 51-60          | 0-26            | 13                         |
| 41-50          | 0-26            | 5                          |
| 27-40          | 0-26            | 3                          |

### 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).
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

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 |
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 sinusal 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.

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.

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

| Degree of Olfaction | Functional Impairment (%) |
|---------------------|---------------------------|
| Normal              | 0                         |
| Hyposmia            | 30                        |
| Anosmia             | 100                       |

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 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 test 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...
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 certificate, 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 exceptions to this rule is total laryngectomy, where the diagnosis is considered permanent.

### Table 5. Classification of airway defects

| Class   | Clinical manifestation | Examination |
|---------|------------------------|-------------|
| I       | Dyspnea does not occur at rest | Partial obstruction of oropharynx, hypopharynx, larynx, upper trachea, lower trachea, or bronchi |
| II      | 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 reveals one or more of the following: |
| III     | Dyspnea is produced by stress, prolonged exertion, hurrying, hill climbing, recreation, or similar activity | Complete obstruction of the nose (bilateral) or nasopharynx |
| IV      | Dyspnea is 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 | |
| V       | 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 | |

### 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.
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 derangements, 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,

| 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 |

| Classification | Mild impairment | Moderate impairment |
|----------------|-----------------|---------------------|
| 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) |

| Classification | Moderate to severe impairment |
|----------------|------------------------------|
| 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 |

| Classification | Severe impairment |
|----------------|-------------------|
| 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 |

| Classification | Most severe impairment |
|----------------|------------------------|
| 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 |
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...
Development of Guideline for Rating the Physical Impairment of Otolaryngologic Field

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, electroneystagmography, 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 (UPST, 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.

REFERENCES

1. Korean Society of Otorhinolaryngology-Head and Neck Surgery. Otorhinolaryngology Head and Neck Surgery. 1st ed. Korea: Iljogak 2002; 695.
2. Korean Audiological Society. Practical manual of Hearing tests. 1st ed. Seoul, Korea: Hakjisa 2008; 41-54.
3. Korean Society of Otorhinolaryngology-Head and Neck Surgery. Disability evaluation guidebook. Seoul, Korea: Korean Society of Otorhinolaryngology-Head and Neck Surgery Press 2007; 13-33.
4. American Medical Association. Guides to the Evaluation of Permanent Impairment. 5th ed. Chicago: AMA Press 2000; 238-43.
5. McBride ED. Disability evaluation and principles of treatment of compensable injuries. 6th ed. Philadelphia: JB Lippincott Co, 1963.
6. Kileny PR, Zwolen TA. Diagnostic and rehabilitative audiology. In: Cummings CW, Flint PW, Harker LA, Haughey BH, Richardson MA, Robbins KT, Schuller DE, Thomas JR, eds. Cummings Otolaryngology Head & Neck Surgery. 4th ed. Philadelphia: Elsevier Mosby 2005; 3483-502.
7. Hall JW III, Antonelli PJ. Assessment of peripheral and central auditory function. In: Bailey BJ, Johnson JT, Newlands SD, eds. Head & Neck Surgery-Otolaryngology. 4th ed. Philadelphia: Lippincott Williams & Wilkins 2006; 1927-42.
8. Korean Society of Otorhinolaryngology-Head and Neck Surgery. Disability evaluation guidebook. Seoul, Korea: Korean Society of Otorhinolaryngology-Head and Neck Surgery Press 2007; 39-43.
9. American Medical Association. Guides to the Evaluation of Permanent Impairment. 5th ed. USA: American Medical Association Press 2000; 244-7.
10. Hullar TE, Minor LB, Zee DS. Evaluation of the patient with dizziness. In: Cummings CW, Flint PW, Harker LA, Haughey BH, Richardson MA, Robbins KT, Schuller DE, Thomas JR, eds. Cummings Otolaryngology Head & Neck Surgery. 4th ed. Philadelphia: Elsevier Mosby 2005; 3160-98.
11. Driscoll CL, Green JD Jr. Balance function test. In: Bailey BJ, Johnson JT, Newlands SD, eds. Head & Neck Surgery-Otolaryngology. 4th ed. Philadelphia: Lippincott Williams & Wilkins 2006; 1917-26.
12. Korean Society of Otorhinolaryngology-Head and Neck Surgery.
13. Leopold DA, Holbrook EH. Physiology of olfaction. In: Cummings CW, Flint PW, Harker LA, Haughey BH, Richardson MA, Robbins KT, Schuller DE, Thomas JR, eds. Cummings Otolaryngology Head & Neck Surgery. 4th ed. Philadelphia: Elsevier Mosby 2005; 865-97.

14. Doty RL, Bromley SM, Panganiban WD. Olfactory function and dysfunction. In: Bailey BJ, Johnson JT, Newlands SD, eds. Head & Neck Surgery-Otolaryngology. 4th ed. Philadelphia: Lippincott Williams & Wilkins 2006; 289-306.

15. Korean Society of Otorhinolaryngology-Head and Neck Surgery. Disability evaluation guidebook. Seoul, Korea: Korean Society of Otorhinolaryngology-Head and Neck Surgery Press 2007; 45-9.

16. American Medical Association. Guides to the Evaluation of Permanent Impairment. 5th ed. USA: American Medical Association Press 2000; 254.

17. Zeiders JW, Pallanch JF, McCaffrey TV. Evaluation of nasal breathing function with objective airway testing. In: Cummings CW, Flint PW, Harker LA, Haughey BH, Richardson MA, Robbins KT, Schuller DE, Thomas JR, eds. Cummings Otolaryngology Head & Neck Surgery. 4th ed. Philadelphia: Elsevier Mosby 2005; 898-933.

18. Korean Society of Otorhinolaryngology-Head and Neck Surgery. Disability evaluation guidebook. Seoul, Korea: Korean Society of Otorhinolaryngology-Head and Neck Surgery Press 2007; 45-9.

19. American Medical Association. Guides to the Evaluation of Permanent Impairment. 5th ed. USA: American Medical Association Press 2000; 251-3.

20. American Medical Association. Guides to the Evaluation of Permanent Impairment. 5th ed. USA: American Medical Association Press 2000; 54.

21. American Medical Association. Guides to the Evaluation of Permanent Impairment. 5th ed. USA: American Medical Association Press 2000; 254-63.