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Transition and trend of study on domestic and overseas anorexia and dysphagia

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Abstract

The purpose of this study is to survey domestic and overseas studies on anorexia and dysphagia and explore their transition and characteristics in each generation. The authors performed a word frequency analysis and a characteristic words analysis by generation using the text mining method for the titles of total 1,638 original papers published in published in the past 33 years in “Dysphagia”, which is an academic journal for swallowing disorders. For studies on swallowing, its examination methods and swallowing function evaluations were mainly conducted in the 1980-1990s, and case reports about swallowing training methods and systematic reviews increased after the 2000s. Moreover, themes for cerebrovascular disorder patients and cancer patients attract researchers’ attention accompanied with global aging. One of the characteristics of the swallowing support system in Japan is that multiple professionals are involved with it.

Key words: Dysphagia, text mining, word frequency analysis, characteristic words analysis

Introduction

“Eating from mouth” gives hope and joy in lives to patients and is a source of their activity. Further, the effect of keeping oral cavity clean is also expected by activation of brain and nerves¹⁾. Team medical care is indispensable for supporting eating and swallowing, and various professionals such as nursing, medicine and dentistry, physical therapists and occupational therapists, speech therapists and dietitians need to share information and cooperate for a team approach^{2,3)}. Eating support is indispensable for elderly people to spend their terminal phase in local and being able to eat by themselves till the end of their lives is the ultimate QOL. The functions of elderly people decreases through weakening progressively while they gradually switch over from their healthy state to the state that they need nursing care and nursing preventive measures at this frail stage are important^{4,5)}. Incidentally, evidences that maintenance and improvement of the oral

cavity function at the period of advanced age are effective for preventing weakening of the entire body have been accumulated so far⁶⁾. In other words, measures for oral frail due to degradation of oral cavity functions are required in addition to physical frail measures, and therefore it is useful to grasp the themes of the studies that have been accumulated so far.

Therefore, this study clarifies surveys papers published in “Dysphagia”, which is an academic journal for swallowing disorders using the text mining analysis, and reveals outlines of the study themes of overseas studies on anorexia and dysphagia. Next, we compare them with study themes of domestic studies and investigate transition of the study themes of studies on anorexia and dysphagia.

Methods

1. Subject paper

Papers published in “Dysphagia”, which is an academic

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journal for swallowing disorders were employed as subjects. Data of papers published in the magazine during the period from 1986 to November 2, 2018 were acquired from the web page of “Dysphagia” and PubMed. Paper titles (phrases included in the titles) were the subjects for the analysis as the minimum unit data for which paper contents were summarized, with subtitles included. “Dysphagia” employed for the present study is an official journal of Dysphagia Research Society, and a number of papers are quoted from it in related fields as authoritative academic journal⁷⁾ specialized in eating and swallowing (2017 Impact Factor 2.531).

2. Analysis method

The study design was comprehensive document retrieval. Appearance frequency of the words used for the titles of all papers and characteristic words by generation were analyzed by the text mining method. The text mining method is a method that arranges text data which is not stylized is arranged according to definite rules by picking up useful information from enormous amount of text information, and perform quantitative analysis such as correlations by data mining⁸⁾. Text Mining Studio 6.1.1 English add-on (NTT DATA Mathematical Systems Inc.) was used as an analysis tool. Characteristic words mean the phrases that appear being deviated to their attributes for which their distribution is considered and therefore they are not simply based on appearance frequency. The complement similarity measure is a value considered high in the appearance ratio, and it is calculated in the next expression.

3. Ethical considerations

Subjects of the content analysis of this study were based on opened information. Ethical consideration was given for the following points. 1) The privacy policy follows “Personal Information Protection Law” and “Ethical Guidelines for Clinical Studies” and 2) in the event that figures, tables and regular texts are quoted from literature, care must be taken so as to avoid copyright violation.

Results

Total 1,638 papers were searched. The results of text data calculation for the analysis, 12,087 phrases were extracted. For each category, 6,691 nouns (55.36%), 859 verbs (7.11%), 437 adjectives (3.61%), 2,660 symbols (22.01%) and 1,440 other phrases (conjunction, preposition) (11.91%) were extracted. Since characteristics of the themes were obtained from nouns, verbs and adjectives in the papers, 7,987 words

were analyzed as analysis subjects.

1. Tendency of phrase used for title

Among the frequently appeared words in the titles of all papers, top 10 phrases were extracted from all papers published. The 1st place of all papers published in the past 33 years is “Swallow”, which appeared 270 times, followed by “Dysphagia (238 times)” and “Patient (136 times)”. The 4th place was “Effect (114 times)”, the 5th place was that are “Use (77 times)”, the 6th place was 53 times that are “Aspiration (53 times)”, the 7th place was “Evaluation (40 times)”, the 8th place was “Oropharyngeal dysphagia (38 times)”, the 9th place was “Head (33 times)” and the 10th place was “Age (27 times).” (Table 1)

2. Characteristic word analysis by generation

The analysis subjects were classified by generation for every ten years, and characteristic words were extracted with considering word frequency based on complement similarity (Table 2). In the 1980s, phrases related to evaluation and examination methods such as “Assessment”, “Evaluation”, “Examination” and “Videofluoroscopic” including “Preliminary observation” were seen. Further, anatomical terms for swallowing such as “Esophageal carcinoma”, “Esophagus” and “Tongue” appeared characteristically. Moreover, the phrase “Multidisciplinary feeding profile”, which means multimodal study, was seen. In the 1990s, phrases such as “Modify”, “Mechanism” “Technique”, “Blue dye procedure” and “Videofluoroscopy” which evaluated clinical condition of dysphagia and swallowing dynamics were seen. As phrases for sites and diseases, “Cerebral palsy” and “Achalasia” newly appeared. In the 2000s, “Effect”, “Comparison”, “Reliability”, “Literature review” and “Clinical”, which mean reliable treatment, were seen. As diseases, “Acute stroke” and “Stroke patient” appeared. “Systematic review” appeared in the 2nd place for the first time since the 2010s began. Phrases expressing individual nature of treatment such as “Oropharyngeal dysphagia” and “Validation” were seen. Moreover, “Parkinson disease”, “Cancer” and “Radiotherapy” were characteristic.

Discussion

1. Transition of overseas study theme

Advanced studies on eating and dysphagia have been conducted with progress of aging, and developed until now. As a back up for it, the number of papers published from 1986 through 2018 increased increased year by year. Transition of the study themes is grasped from the characteristics of the

Table 1. Top 10 Characteristic Words Related to Deglutition by Frequency (n=7,987)

Rank	Order	1	2	3	4	5	6	7	8	9	10
1986-1989	Swallow	Swallow	Dysphagia	Patient	Evaluation	Effect	Use	Child	Esophagus	Dysphagic phonocent	Aspiration
1990-1999	Dysphagia	Swallow	Swallow	Patient	Aspiration	Use	Effect	Esophagus	Comment	Stroke	Evaluation
2000	Swallow	Swallow	Aspiration	Child	Patient	Oropharyngeal dysphagia	Effect	Adult	Use	Comment	Cerebral palsy
2001	Swallow	Swallow	Dysphagia	Effect	Patient	Aspiration	Child	Oropharyngeal dysphagia	Cerebral palsy	Age	Associate
2002	Swallow	Swallow	Dysphagia	Patient	Acute stroke	Effect	Reliability	Adult	Use	Evaluation	Management
2003	Swallow	Swallow	Dysphagia	Patient	Effect	Evaluation	Case report	Comparison	Study	Age	Use
2004	Swallow	Swallow	Dysphagia	Use	Elderly	Patient	Adult	Evaluation	Oropharyngeal dysphagia	Case report	Videofluoroscopy
2005	Swallow	Swallow	Dysphagia	Effect	Patient	Development	Fee	Acute stroke	Pharyngeal	Comparison	Use
2006	Swallow	Swallow	Dysphagia	Effect	Use	Patient	Associate	Measure	Aspiration	Analysis	Evaluate
2007	Swallow	Swallow	Dysphagia	Effect	Patient	Management	Analysis	Evaluation	Associate	Measure	Clinical
2008	Swallow	Swallow	Patient	Effect	Oral	Parkinson disease	Dysphagia	Pharyngeal	Case report	Esophagus	Stroke
2009	Swallow	Swallow	Dysphagia	Effect	Patient	Pharyngeal	Function	Age	Neck	Head	Videofluoroscopy
2010	Swallow	Swallow	Dysphagia	Patient	Oropharyngeal dysphagia	Esophagus	Aspiration	Impact	Effect	Age	Neck
2011	Swallow	Swallow	Dysphagia	Patient	Effect	Use	Parkinson disease	Aspiration	Neck	Head	Validation
2012	Effect	Swallow	Swallow	Dysphagia	Patient	Use	Parkinson disease	Head	Evaluation	Age	Associate
2013	Swallow	Swallow	Dysphagia	Effect	Use	Patient	Head	Neck	Validation	Systematic review	Cancer
2014	Swallow	Swallow	Dysphagia	Effect	Use	Patient	Aspiration	Parkinson disease	Oropharyngeal dysphagia	Function	Validation
2015	Swallow	Swallow	Patient	Effect	Dysphagia	Systematic review	Evaluation	Elderly	Use	Function	Cancer
2016	Dysphagia	Swallow	Swallow	Patient	Oropharyngeal dysphagia	Effect	Use	Head	Outcome	Reliability	Validation
2017	Dysphagia	Swallow	Swallow	Patient	Head	Oropharyngeal dysphagia	Change	Evaluation	Effect	Adult	Development
2018	Dysphagia	Swallow	Swallow	Patient	Effect	Use	Change	Evaluation	Evaluate	Fee	Head
All period	Swallow	Swallow	Dysphagia	Patient	Effect	Use	Aspiration	Evaluation	Oropharyngeal dysphagia	Head	Age

The 1st place of all papers published in the past 33 years is “Swallow”, followed by “Dysphagia” and “Patient”.

Table2. Characteristic Words in Each Period

(n=7,987)

Rank Order	1986–1989		1990–1999		2000–2009		2010–2018	
	Word	CSM*	Word	CSM*	Word	CSM*	Word	CSM*
1	Swallow	47.46	Dysphagia	48.50	Swallow	25.60	Head	29.88
2	Preliminary observation	16.67	Aspiration	27.53	Effect	19.34	Systematic review	25.97
3	Patient	14.36	Comment	25.71	Child	14.10	Neck	15.55
4	Assessment	11.41	Esophagus	22.95	Case report	13.73	Oropharyngeal dysphagia	13.19
5	Dysphagic Patient	10.71	Stroke	15.15	Acute stroke	11.80	Validation	12.18
6	Evaluation	9.06	Paharynx	14.28	Stroke patient	10.51	Swallowing	11.44
7	Dependent feeder	8.68	Modify	12.70	Normal swallowing	9.88	Change	10.50
8	Dysfunctional	8.68	Cerebral palsy	11.75	Comparison	9.62	Treat	9.96
9	Esophageal carcinoma	8.68	Abstract	11.59	Pharyngeal	9.00	Parkinson disease	9.15
10	Examination	8.68	Study	11.36	Oral	8.66	Relate	8.82
11	Multidisciplinary feeding profile	8.68	Achalasia	9.39	Gender	8.29	Effect	8.01
12	Pharyngeal function	8.68	Blue dye procedure	9.07	Adult	8.07	Cancer	7.07
13	Pharyngeal swallow	8.22	Management	8.99	Measure	8.03	Aspiration	6.86
14	Normal adult	7.99	Sound	8.52	Reliability	8.03	Children	6.86
15	Tongue	7.76	Videofluoroscopy	8.05	Compare	7.99	Function	6.86
16	Videofluoroscopic	7.76	Esophageal dysphagia	7.25	Literature review	7.96	Pilot Study	6.86
17	Neurogenic dysphagia	7.53	Dysphagic patient	7.02	Clinical	7.37	Radiotherapy	6.86
18	Child	7.49	Mechanism	6.70	Rat	7.33	Life	5.72
19	Esophagus	7.49	Technique	6.70	Report	6.70	Management	5.72
20	Correlation	7.07	Deglutition	6.31	Treatment	6.44	Validation	5.72

*CSM: Complementary Similarity Measure

In the 1980s, phrases related to evaluation and examination methods such as “Assessment”, “Evaluation.” In the 1990s, phrases such as “Modify”, “Mechanism” “Technique”, “Blue dye procedure” and “Videofluoroscopy” which evaluated clinical condition of dysphagia and swallowing dynamics were seen. In the 2000s, “Effect”, “Comparison”, “Reliability”, “Literature review” and “Clinical”, which mean reliable treatment, were seen.

phrases by a word frequency analysis. Viewing the trend of the study themes, it is understood from “Blue dye procedure”, “Videofluoroscopy”, “Evaluation”, “Assessment” and “Mechanism” which are the phrases appearing quite frequently in the studies published from the 1980s through the 1990s that studies on evaluation of swallowing mechanism and swallowing functions were mainstream. It was the period when the therapeutic viewpoint was still weak and effects of the swallowing training were discussed⁹⁾. However, the authors presume that clinical studies carried out in this period promoted techniques for the swallowing function test, and the base for the current swallowing training method was built. Photofluoroscopic examinations with cine films was mainstream for swallowing function tests until the 1970s, and shooting methods with video spread from the 1980s¹⁰⁾. This swallowing cystography examination is a useful technique that allows observation of passage conditions of food bolus through X-rays. They are used in various clinical scenes in the world, and most of the evidences for swallowing training methods have been obtained from swallowing cystography. In this way, this technique came to be called “gold standard” for swallowing, examina-

tions, and was established as a core technique for dysphagia through the studies conducted in this period.

After 2000, the phrases such as “Effect”, “Comparison”, “Measure”, “Case report” and “Clinical” were seen, which indicates that studies that performed medical intervention for the swallowing mechanism that had been elucidated by then and evaluated treatment effects increase. Their results were further published as “Case report”. In other words, the number of studies that applied results of fundamental researches to treatments increased, the idea of rehabilitation was introduced for the dysphagia patients who had been unable to receive treatment till then. Moreover, evaluation and inspection came to be performed from the viewpoint of how eating and swallowing methods that lead to training can be performed (best swallow)⁹⁾. Further, in the 2010s, in response to the trend of evidence-based medicine (EBM), researchers’ trend to gather up findings from the “Systematic review” and strengthen evidences even more is seen.

For the subject diseases for the studies, “Acute stroke” and “Stroke patient” appeared in the 2000s, and “Cancer” was extracted from the 2010s. Studies on cerebrovascular disorder

Table3. Characteristic Words in Each Period in Japan

(n=2,678)

Rank Order	1982–1989		1990–1999		2000–2009		2010–2017	
	Word	CSM*	Word	CSM*	Word	CSM*	Word	CSM*
1	Mastication	46.05	Dysphagia	77.74	Dysphagia	83.07	Case	43.90
2	Masticatory strength	28.14	Support	33.91	Approach	20.50	Amelioration	21.07
3	Disability	18.12	Patient	28.95	Deglutitory rehabilitation	18.16	Elderly patient	16.15
4	Food	17.06	Oral intake	23.27	Nurse	16.84	Comparison	14.74
5	Eating function	16.84	Influence	20.02	Muscular dystrophy patient	15.07	Association	13.20
6	Severe disability	13.86	Mastication	18.13	Deglutition ractice	14.68	Aspiration pneumonia	12.70
7	Achalasia	9.38	Eating function	15.24	Care system	13.33	Problem	10.95
8	Mechanism	9.38	Evaluation	14.97	Development	12.64	Oral intake	10.90
9	Abutment tooth	9.38	Application	14.70	Bolus	12.37	Gastrostomy	10.56
10	General situation	9.38	Deglutition disability	14.70	Problem	12.37	Factor	10.26
11	Weaning	9.38	Eating function	14.43	Mastication	11.86	Deglutition rehabilitation	10.16
12	Motor function factor	9.38	Independence	14.25	Attempt	11.71	Validation	10.05
13	Electromyography	9.38	Observation	12.35	Overall finding	11.53	This hospital	9.05
14	Emergency operation	9.38	Nursing	11.72	Eating function	11.47	Development	8.91
15	Linguistic competence	9.38	Function Disability	11.09	Instance	11.29	Registered dietitian	8.66
16	Surgical care	9.38	Advancement	11.00	Cerebrovascular disorder	10.42	Healthy people	8.56
17	Severe pediatric disability	9.38	Severe disability	10.82	Diacrisis	10.21	Supervenience	8.56
18	Evaluation Method of food	9.38	Oral nelaton method	10.82	Challenge	9.76	Aspiration pneumonitis person	8.45
19	Esophageal reconstruction	9.38	Oral state	10.82	Swallowing mechanism	9.73	Association	8.37
20	EMG study	9.38	Countermeasure	10.55	Patient education on deglutition	8.89	Food form	8.04

*CSM: Complementary Similarity Measure

Phrases related to “Mastication”, “Eating function”, “Evaluation” and “Mechanism” were seen from the 1980s. Moreover, phrases about nursing support such as “Dysphagia”, “Support”, “Patient”, “Independence”, “Observation” and “Nursing” were extracted from the 1990s. For the 2000s, the phrases “Deglutitory rehabilitation” and “Nurse” appeared for the first time, and the phrases “Muscular dystrophy patient” and “Cerebrovascular disorder” were seen. For the 2010s, “Case”, “Amelioration” and “Elderly patient” appeared.

Citation; Shimotakahara, et al. Literature research on dysphagia in Japan; overview of studies from 1982 to 2017 by article title. 2018.

patients and cancer patients increased in these stages. Their back ground is population aging on a global basis due to extension of average life and decline in the birthrate. According to a survey by the United Nations, The elderly population exceeded the population of children in the advanced countries in 1998¹¹⁾, which is the period that phrases about cerebrovascular disorder patients and the cancer patients were extracted. In recent years, elderly patients of cerebrovascular disorder and cancer, in addition to childhood diseases and neurologic intractable diseases, are increasing and therefore studies on eating and swallowing will be more and more important, we presume.

2. Trend of theme of domestic study

In the trend of swallowing-related studies in Japan we investigated in the past¹²⁾, phrases related to “Mastication”, “Eating function”, “Evaluation” and “Mechanism” were seen from the 1980s (Table 3). Moreover, phrases about nursing support such as “Dysphagia”, “Support”, “Patient”, “Independence”, “Observation” and “Nursing” were extracted from the

1990s. Here, comparing this investigation result with Japan, the phrase “Evaluation”, “Mechanism” and “Achalasia” commonly appeared.

For the 2000s, the phrases “Deglutitory rehabilitation” and “Nurse” appeared for the first time, and the phrases “Muscular dystrophy patient” and “Cerebrovascular disorder” were seen. For the 2010s, “Case”, “Amelioration” and “Elderly patient” appeared, and at the same time, characteristic phrases such as “Aspiration pneumonia”, “Gastrostomy” and “Registered dietitian” were seen. In other words, for the period from 2000 to 2010, “Cerebrovascular disorder”, “Acute stroke” and “Stroke patient” attracted interest at home and abroad. Moreover, “Aspiration” and “Aspiration pneumonia” commonly appeared. In other words, it is understood that studies on dysphagia in Japan progressed as those in foreign countries did. However, as for study methods, there had been case reports in Japan, while on the other hand phrases such as “Systematic review” and “Literature review” were not seen. In this way, swallowing-related studies in Japan are based on “evaluation” followed by “practice”, and most of the studies are case re-

ports as a characteristic.

Moreover, the phrases “rehabilitation”, “nursing” and “health care system” often appear in Japanese literature, indicating that multiple types of professions are involved in swallowing support. The aging rate of Japan is high in the world, and the post-baby boomers will be latter-stage elderly (75 years old or older) by about 2025 in our country, “The 2025 problem” for which rapid increases of the social security budget for nursing and medical costs were concerned is coming up soon¹³⁾. Therefore, various measures were performed, and in particular, systems for providing medical care and nursing in local communities were greatly changed by “Draft Act on Amending Law to the Related Acts for Securing Comprehensive Medical and Long-Term Care in the Community” established in 2014¹⁴⁾.

For dentistry, the system of “regular dentist enhancement type dental clinic” was newly set up by the revision of medical service fees in 2016, and dentistry has been shifting from doctor’s office contained type to local contained type. In this way, since aging and disease structure change in odontopathy produced new needs, and measures for preventing deterioration of oral cavity functions in the period of advanced age were demanded¹⁵⁾, themes related to multiple types of professions and health care systems increased, the authors guess.

Conclusions

1. Overseas swallowing-related studies started with swallowing functional evaluation in the 1980s, and case reports on swallowing training methods and systematic reviews are increasing nowadays.
2. In studies in domestic and foreign, themes for cerebrovascular disorder patients and cancer patient attracts attention accompanied with aging on a global scale after the 2000s.
3. The characteristic point of the swallowing support system in Japan is that multiple types of professions are involved in it.

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