The Digital Swallowing Workstation contains a complete videoendoscopic system for administering FEES exams at bedside. All components have been selected to provide excellent endoscopic images needed to evaluate swallowing function. The hardware consists of a xenon light source, a flexible endoscope, and a CCD camera with lens adapter. The swallowing cart houses all components and includes an optional caddy system for the endoscope(s). As an integrated part of the Digital Swallowing Workstation, FEES exams are digitally recorded for immediate exam review. Additionally, FEES procedures can be recorded concurrently with any combination of signals on the Swallowing Signals Lab.

FEES PROCEDURE
FEES is an endoscopic technique used for the clinical evaluation of dysphagic patients. It can be performed in the clinic or the system can be rolled to the patient’s room for bedside evaluation. In the procedure, a flexible endoscope is passed transnasally, allowing the clinician to view laryngeal and pharyngeal structures during both swallowing and non-swallowing tasks. Swallowing function is observed endoscopically while feeding the patient various bolus consistencies and volumes, each colored with food dye to assist with exam interpretation. In addition to its assessment function, FEES can be used to help educate patients and family about swallowing problems and also to demonstrate effective practice of compensatory techniques.

An Integrated Workstation
The Digital Swallowing Workstation is a comprehensive system designed to meet the extensive requirements of dysphagia clinicians and researchers. It has been installed at top facilities internationally because of its unmatched set of features and capabilities to analyze and treat swallowing problems. Each of the analysis techniques offered in the system has been validated by numerous peer-reviewed articles in medical journals (an extensive bibliography and collection of application notes are available on request). All components of the workstation are housed on a customized mobile cart for convenience and clinical efficiency.

Key Benefits:
- Perform FEES procedure at patient bedside
- No radiation exposure to patient
- Excellent visualization of secretions and penetration
- Allows experimentation of swallowing maneuvers and therapy planning
- During FEES exam, patients can ingest foods normally eaten
- Excellent complementary procedure to modified barium studies

Digital video recording system for fluoroscopic and FEES exams
Objective measurements of key physiologic parameters related to swallowing
Real-time visual feedback for patients to assist with therapy goals
Complete videodeendoscopic (FEES) system for bedside evaluation
Time-linked video and physiologic data for comprehensive assessment
Fully integrated exam management system with patient database
Report generator containing critical exam findings and images
Mobile cart for all system components
The Digital Swallowing Workstation (DSW) is a powerful, multi-functional system containing a robust set of features that have been integrated into one platform for dysphagia clinicians and researchers. DSW can be used to assist with virtually every aspect of patient management, from initial assessment through rehabilitation.

Comprised of three separate modules (available separately), the complete workstation offers an unparalleled assortment of capabilities using established techniques that were previously available only as multiple instruments from many vendors. The workstation, which ergonomically integrates these disparate technologies, enhances clinical efficiency and contributes to evidence-based clinical practice. To the research community, the workstation provides both sophistication and flexibility for data acquisition, analysis, time-linked physiologic and video data, as well as the ability to export quantitative information into other analysis software.

No other system offers dysphagia clinicians and researchers the comprehensiveness and flexibility of DSW. Since its introduction in the mid-1990s (originally as an analog system), the workstation has evolved into the system of choice for dysphagia clinicians and researchers the comprehensiveness and flexibility of DSW. Since its introduction in the mid-1990s (originally as an analog system), the workstation has evolved into the system of choice for dysphagia clinicians and researchers. DSW can be used to assist with virtually every aspect of patient management, from initial assessment through rehabilitation.

Digital Video Recording System

A POWERFUL MOTION VIDEO SYSTEM

The Digital Video System for Swallowing (DVSS) module records modified barium, videostroscopic (FEES), ultrasound, and other video exam studies directly to computer storage media for immediate retrieval and playback. The professional video acquisition hardware (with audio) provides excellent image quality at full video resolution without artifacts or skipped frames. DVSS is a self-contained digital video recording system, but can also be used in conjunction with the Swallowing Signals Lab (see next page), when used in combination, these modules allow digital video and physiologic data to be recorded and playback conveniently for precise, time-linked data analysis.

IMMEDIATE EXAM REVIEW

In addition to superb image quality, dysphagia clinicians can take advantage of many conveniences and time-saving features provided with digital video recording. The system is housed on a mobile cart that can be rolled to radiology or to patient bed-side to record a procedure. With instant exam retrieval, the clinician can quickly analyze any segment of the exam in real time, frame by frame, or in slow motion. The most reveling still images can be selected and labeled for seamless inclusion in the software’s report generator.

SIMULTANEOUS PLAYBACK OF TWO EXAMS

Two video recordings can be loaded and compared side by side. This unique feature facilitates simultaneous assessment (i.e., pre and after therapy) for precise, time-linked data analysis.

Key Benefits

- Immediate access to excellent quality digital recordings
- Review procedures in real time, frame by frame, or in slow motion
- Use built-in tracking system to locate exams
- Quick duration measurements of swallowing events
- Enhance images with zoom, contrast, and brightness controls
- Easily convert video clips to standard multimedia video formats
- Select exact stills to include in reports
- Export stills to other programs for further data analysis

Swallowing Signals Lab

SWALLOWING PHYSIOLOGY ASSESSMENT AND VISUAL FEEDBACK

The Swallowing Signals Lab is both a physiological data acquisition and visualization feedback system for dysphagic patients that provides real-time displays of critical parameters related to swallowing function. It consists of a custom external module with a PC interface card and an array of measurement tools (i.e., transducers), which have been described extensively in the dysphagia professional literature. Previously available as separate, stand-alone instruments, these transducers have been integrated into a single system for swallowing.

All aspects of data sampling and signal conditioning (unique to each transducer), and the concurrent real-time display of any combination of these signals, are designed into the system. Additionally, when used in conjunction with the Digital Video System for Swallowing, these physiological signals can be viewed and analyzed with video data (e.g., fluorographic or videoendoscopic).

MULTIPLE TRANSDUCERS RATIONALE

Dysphagia can have an array of contributing factors which a clinician may wish to address in patient assessment and treatment. Clinicians and researchers have reported a variety of therapy techniques in books and professional journals. The Swallowing Signals Lab integrates many of these key techniques based on their reported usefulness and efficacy.

The system includes surface EMG (two channels), tongue pressure transducers (two and three-channel configurations), solid-state pharyngeal/UES manometry (up to six channels), cervical auscultation, and respiratory phase (middle), and cervical auscultation (bottom) of the standard signals provided, two auxiliary channels are applied. Any combination of signals can be acquired simultaneously. Standard measurements can be made on any of the data. For researchers, data can be easily exported as a text file for further analysis in other programs.

Key Benefits

- Help patients achieve therapy goals with real-time feedback
- Use objective measurements to assist with evidence-based practice
- Teach swallowing maneuvers with surface EMG (two channels)
- Measure tongue strength objectively and use for isometric exercises
- Show coordination of breathing and swallowing with effective real-time displays
- Acquire signal and video data concurrently (e.g., manometric/time/position) for precise data correlation and comprehensive assessment
- Access built-in measurement functions for standard clinical practice

Strengthening exercises for the tongue can be enhanced with real-time displays and objective measurements.
The Digital Swallowing Workstation (DSW) is a powerful, multi-functional system containing a robust set of features that have been integrated into one platform for dysphagia clinicians and researchers. DSW can be used to assist with virtually every aspect of patient management, from initial assessment through rehabilitation.

Comprised of three separate modules (available separately), the complete workstation offers an unparalleled assortment of capabilities using established techniques that were previously available only as multiple instruments from many vendors. The workstation, which ergonomically integrates these disparate technologies, enhances clinical efficiency and contributes to evidence-based clinical practice. To the research community, the workstation provides both sophisticated and flexibility for data acquisition, analysis, time-linked physiologic and video data, as well as the ability to export quantitative information into other analysis software.

No other system offers dysphagia clinicians and researchers the comprehensiveness and flexibility of DSW. Since its introduction in the mid-1990s (originally as an analog system), the system has been expanded to include digital video recording, a feature that provides real-time displays of critical parameters related to swallowing function. It consists of a custom external module with a PC interface card and an array of measurement tools (i.e., transducers), which have been described extensively in the dysphagia professional literature. Previously available as separate, stand-alone instruments, these transducers have been integrated into a single system for swallowing.

**Key Benefits**

- **Immediate access to excellent quality digital recordings**
- **Review procedures in real time, frame by frame, or in slow motion**
- **Use built-in tracking system to locate exams**
- **Quick duration measurements of swallowing events**
- **Enhance images with zoom, contrast, and brightness controls**
- **Easily convert video clips to standard multimedia video formats**
- **Select exact stills to include in reports**
- **Export stills to other programs for further data analysis**

**The Digital Swallowing Workstation**

**A POWERFUL MOTION VIDEO SYSTEM**

The Digital Video System for Swallowing (DVSS) module records modified barium, videoendoscopic (FEES), ultrasonic, and other video exam studies directly to computer storage media for immediate retrieval and playback. The professional video acquisition hardware (with audio) provides excellent image clarity at full video resolution without artifacts or skipped frames. DSS is a self-contained digital video recording system, but can also be used in conjunction with the Swallowing Signals Lab (see next page), when used in combination, these modules allow digital video and physiologic data to be recorded and played back concurrently for precise, time-linked data analysis.

**IMMEDIATE EXAM REVIEW**

In addition to superb image quality, dysphagia clinicians can take advantage of many conveniences and time-saving features provided with digital video recording. The system is housed on a mobile cart that can be used in radiology or patient bed-side to record a procedure. With instant exam retrieval, clinicians can quickly review any segment of the exam in real time, frame by frame, or in slow motion. The most revealing still images can be selected and stored for future reference in the software's report generator.

**SIMULTANEOUS PLAYBACK OF TWO EXAMS**

Two video recordings can be loaded and compared side by side. This unique feature facilitates on-screen assessment of in-depth comparative analysis of patient performance over time (e.g., before and after therapy).

**Swallowing Signals Lab**

**SWALLOWING PHYSIOLOGY ASSESSMENT AND VISUAL FEEDBACK**

The Swallowing Signals Lab is both a physiologic data acquisition and visual feedback system for dysphagia patients that provides real-time displays of critical parameters related to swallowing function. It consists of a custom external module with a PC interface card and an array of measurement tools (i.e., transducers), which have been described extensively in the dysphagia professional literature. Previously available as separate, stand-alone instruments, these transducers have been integrated into a single system for swallowing.

**Key Benefits**

- **Help patients achieve therapy goals with real-time feedback**
- **Use objective measurements to assist with evidence-based practice**
- **Teach swallowing maneuvers with surface EMG (two channels)**
- **Measure tongue strength objectively and use for isometric exercises**
- **Show coordination of breathing and swallowing with effective real-time displays**
- **Acquire signal and video data concurrently (e.g., manofluorographic studies for standard clinical practice)**

**MULTIPLE TRANSDUCERS RATIONAL**

Dysphagia can have an array of contributing factors which a clinician may wish to address in patient assessment and treatment. Clinicians and researchers have reported a variety of therapy techniques in books and professional journals. The Swallowing Signals Lab integrates many of these key techniques based on their reported usefulness and efficacy.

The system includes surface EMG (two channels), tongue pressure transducers (two- and three-channel configurations), sub-glottic pharyngeal and glottic manometry (up to six channels), cervical auscultation, and respiratory phase (using a nasal cannula with pressure transducer). Each of these has been included in the Swallowing Signals Lab complete with appropriate signal conditioning.

For clinicians who wish to integrate other types of physiologic data (e.g., pharyngomyography) in conjunction with the standard signals provided, two auxiliary channels are supplied. Any combination of signals can be acquired concurrently. Standard measurements can be made on any of the data. For researchers, data can be easily exported as a text file for further analysis in other programs.

**Swallowing Signals Lab Integration data acquisition and playback from five aqueous transducers (see transducers chart) into a single system.**

**Comparison of breathing and swallowing events can be viewed with sEMG (two channels), tongue pressure transducers, and cervical auscultation (left channel).**

**Access built-in measurement functions for standard clinical practice**

**Strengthening exercises for the tongue can be enhanced with real-time displays and objective measurements.**
The Digital Swallowing Workstation (DSW) is a powerful, multi-functional system containing a robust set of features that have been integrated into one platform for dysphagia clinicians and researchers. DSW can be used to assist with virtually every aspect of patient management, from initial assessment through rehabilitation.

Comprised of three separate modules (available separately), the complete workstation offers an unparalleled assortment of capabilities using established techniques that were previously available only as multiple instruments from many vendors. The workstation, which ergonomically integrates these disparate technologies, enhances clinical efficiency and contributes to evidence-based clinical practice. To support the research community, the workstation provides both sophistication and flexibility for data acquisition, analysis, time-linked physiologic and video data, as well as the ability to export quantitative information into other analysis software.

No other system offers dysphagia clinicians and researchers the comprehensiveness and flexibility of DSW. Since its introduction in the mid-1990s (originally as an analog system), the workstation has evolved into the system of choice at the leading dysphagia clinic and research institutions worldwide.

Digital Video Recording System

The Digital Video System for Swallowing (DVSS) module records modified barium, videofluoroscopic (VFS), ultrasonic, and other video exam studies directly to computer storage media for immediate retrieval and playback. The professional video acquisition hardware (with audio) provides excellent image quality at full video resolution without artifacts or skipped frames. DVSS is a self-contained digital video recording system, but can also be used in conjunction with the Swallowing Signals Lab (see next page), when used in combination, these modules allow digital video and physiologic data to be recorded and played back concurrently for precise, time-linked data analysis.

Exam Management System

The KayPENTAX system alleviates the clinician’s burden of therapy techniques in books and professional journals. The Swallowing Signals Lab complete with appropriate signal transducers can be used in conjunction with the Digital Video System for swallow and serve as a mobile cart that can be rolled to radiology or to patient bedside to record an exam.

Immediate Exam Review

In addition to superb image quality, dysphagia clinicians can take advantage of many conveniences and time-saving features provided with digital video recording. The system is housed on a mobile cart that can be rolled to radiology or to patient bedside to record an exam. With instant exam retrieval, the clinician can quickly analyze any segment of the exam in real time, frame by frame, or in slow motion. The most revealing still images can be selected and labeled for earmark exclusion in the software’s report generator.

Simultaneous Playback of Two Exams

Two video recordings can be loaded and compared side by side. This unique feature facilitates accurate assessment and in-depth comparative analysis of patient performance over time (e.g., before and after therapy). The Digital Swallowing Workstation (DSW) integrates data acquisition and display from five separate transducers (five separate measurement channels) into a single system.

Swallowing Signals Lab

Swallowing Physiology Assessment and Visual Feedback

The Swallowing Signals Lab is both a physiologic data acquisition and visual feedback system for dysphagia patients that provides real-time displays of critical parameters related to swallowing function. It consists of a custom external module with a PC interface card and an array of measurement tools (i.e., transducers), which have been described extensively in the dysphagia professional literature. Previously available as separate, stand-alone instruments, these transducers have been integrated into a single system for swallowing.

All aspects of data sampling and signal conditioning (unique to each transducer), and the concurrent real-time display of any combination of these signals, are designed into the system. Additionally, when used in conjunction with the Digital Video System for Swallowing, these physiologic signals can be viewed and analyzed with video data (e.g., fluorographic or videoendoscopic).

Multiple Transducers Rationale

Dysphagia can have an array of contributing factors which a clinician may wish to address in patient assessment and treatment. Clinicians and researchers have reported a variety of therapy techniques in books and professional journals. The Swallowing Signals Lab integrates many of these key techniques based on their reported usefulness and efficacy.

The system includes surface EMG (two channels), tongue pressure transducer (two- and three-channel configurations), solid-state pharyngual and UES manometry (up to six channels), cervical auscultation, and respiratory phase (using a nasal cannula with pressure transducer). Each of these has been included in the Swallowing Signals Lab complete with appropriate signal conditioning.

For clinicians who wish to integrate other types of physiologic data (e.g., pharyngometry) in conjunction with the standard signals provided, two auxiliary channels are supplied. Any combination of signals can be acquired concurrently. Standard measurements can be made on any of the data. For researchers, data can be easily exported as a text file for further analysis in other programs.

Key benefits

- Immediate access to excellent quality digital recordings
- Review procedures in real time, frame by frame, or in slow motion
- Use built-in tracking system to locate exams
- Quick duration measurements of swallowing events
- Enhance images with zoom, contrast, and brightness controls
- Easily convert video clips to standard multimedia video format
- Select exact stills to include in reports
- Expert-still to other programs for further data analysis

Exam generator

After the clinician has filled in appropriate database fields with key exam findings and selected the most revealing still images, the workstation generates a report as a Microsoft Word document. The system’s printer can make a hard copy of the report for patient records, a referring physician, or insurance filing.

Key benefits

- Help patients achieve therapy goals with real-time feedback
- Use objective measurements to assist with evidence-based practice
- Teach swallowing maneuvers with surface EMG (two channels)
- Measure tongue strength objectively and use for isometric exercises
- Show coordination of breathing and swallowing with effective real-time displays
- Acquire signal and video data concurrently (e.g., manopharyngeal studies) for precise data correlation and comprehensive assessment
- Access built-in measurement functions for standard clinical practice

Swallowing physiology assessment and visual feedback

Strengthening exercises for the tongue can be enhanced with real-time displays and objective measurements.
Digital Swallowing Workstation
An Integrated System for Clinicians   Researchers

Key Benefits:
• Perform FEES procedure at patient bedside
• No radiation exposure to patient
• Excellent visualization of secretions and penetration
• Allows experimentation of swallowing maneuvers and therapy planning
• During FEES exam, patients can ingest foods normally eaten
• Excellent complimentary procedure to modified barium studies

Fiberoptic Endoscopic Evaluation of Swallowing (FEES)

A COMPLETE VIDEOENDOSCOPIC SYSTEM
The Digital Swallowing Workstation contains a complete videoendoscopic system for administering FEES exams at bedside. All components have been selected to provide excellent endoscopic images needed to evaluate swallowing function.

The hardware consists of a xenon light source, a flexible endoscope, and a CCD camera with lens adapter. The swallowing cart houses all components and includes an optional caddy system for the endoscope(s). As an integrated part of the Digital Swallowing Workstation, FEES exams are digitally recorded for immediate exam review. Additionally, FEES procedures can be recorded concurrently with any combination of signals on the Swallowing Signals Lab.

FEES PROCEDURE
FEES is an endoscopic technique used for the clinical evaluation of dysphagic patients. It can be performed in the clinic or the system can be rolled to the patient’s room for bedside evaluation. In the procedure, a flexible endoscope is passed transnasally, allowing the clinician to view laryngeal and pharyngeal structures during both swallowing and non-swallowing tasks. Swallowing function is observed endoscopically while feeding the patient various bolus consistencies and volumes, each coloured with food dye to assist with exam interpretation.

In addition to its assessment function, FEES can be used to help educate patients and family about swallowing problems and also to demonstrate effective practice of compensatory techniques.

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An Integrated Workstation
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For further information on the Digital Swallowing Workstation or other KayPENTAX products, contact the company or your local representative.

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