TELEMEDICINE APPLICATION FOR OROPHARYNGEAL DYSPHAGIA PATIENTS
What we will like to explain?

- Current model of therapy.
- Face-to-face vs. distance model of treatment.
- Why e-dis?
- How e-dis works?
- Pilot study.
- What we have learnt from patients and families/caregivers?.
- What we have learnt from therapist?.
- Conclusions.
The current model of treatment for dysphagic patients is based on face-to-face therapy.
Current model of dysphagia therapy: face-to-face

Our face-to-face model implies:

➔ 2 PM&R visits: initial and discharge.

➔ Outpatient treatment: maximum of 13 outpatient sessions no necessary consecutively.

➔ Need of transportation.

➔ Need of family/caregiver who accompanies and waits during therapy.

➔ Most of pt’s will not carry on with the exercises when the therapy is over.
What is done in the face-to-face program?

- Clinical evaluation
What is done in the face-to-face program?

- Clinical evaluation +/- Videofluoroscopy.
What is done in the face-to-face program?

- Teach compensatory strategies: postural changes and volume-viscosity modifications.
- +/- Teach swallow maneuvers.
What is done in the face-to-face program?

- Do exercises without swallow to improve ROM and strengthening.
We proposed the **telemedicine’s use** for neurological dysphagic patients to **substitute a part of the face-to-face therapy** and **monitor** patient’s performance.
Alternative model:

→ Home based with *distant monitoring*
Benefits from home based programs

Home based programs appear to be superior to center based programs in terms of the adherence to exercise especially in the long-term.

Cochrane Database Syst Rev.
Why e-dis?
Why e-dis?

Technology (*Tekhnē*).

Medicine (*Medicina*).
The **use of telemedicine** for neurological dysphagic patients **should permit:**

- To do **well controlled therapy at home** with equivalent results to hospital based.
- To monitor efficacy, efficiency and effectiveness of the treatment.
- To evaluate patients and family/caregiver satisfaction.
**Background**

- Prevalence of oropharyngeal functional dysphagia is very high in patients with neurological disease:
  - > 30% of patients having had a CVA.
  - Parkinson’s disease: 52-82%.
  - It is first symptom for 60% of patients with ALS.
  - It affects 40% of patients with myasthenia gravis, up to 44% of patients with MS.
  - Alzheimer’s disease: 84% of pts.
  - More than 60% of elderly institutionalized pts.

Background

The most common consequences are:

- **Malnutrition**, with a high prevalence in these patients.

- **Tracheobronchial aspiration**, which is the main cause of mortality.

  - Smith Hammond CA, Goldstein LB. Cough and aspiration of food and liquids due to oral-pharyngeal dysphagia; ACCP evidence-based clinical practice guidelines. Chest 2006;129:154S–168S.
Presence of **dysphagia** predicts need of assistance of another person at rehabilitation discharge (*the association remains strong at one year*).

Dysphagia adversely affects quality of life.

The treatment of oropharyngeal dysphagia reduces the incidence of aspiration pneumonia and improves the nutritional status.
The treatment of oropharyngeal dysphagia is based on:

- Dietary modifications.
- Postural changes.
- Swallow Exercise to strengthen swallowing muscles.
- Others:
  - cricopharyngeal myotomy.
  - BTX-A UES infiltration.
Telemedicine

The system that support the health care process by providing the means for more effective and more efficient information exchange.

The system e-dis is a telemedicine application that aims to replace a part of the treatment of oropharyngeal dysphagia through the use of ICTs.
What part of the therapy is done with e-dis?

Exercise to improve ROM and strength.
It exits evidence that swallow musculature increase strength/tone with non-swallow exercises and increased strength/tone translates into improved function.

How e-dis works?
How e-dis works?

face-to-face model

= e-dis model

=
How e-dis works?
How e-dis works?
How e-dis works?
How e-dis works?

http://www.disfagia.hoyunpocomejor.net/
Patients watch a video where the doctor performs the exercises and gives specific instructions for proper performance.
How e-dis works?

Patients tape videos making exercises and send them through e-dis system.
Therapist watch the patient’s videos and send feedback to them
Patients read the therapist’s comments and replay
Clinical pilot study

The initial hypothesis is that the use of telemedicine (e-dis) is comparable to conventional therapy in terms of patient outcomes.
How to evaluate treatment?

A full health treatment evaluation should include four outcomes:

- Clinical status;
- Health care costs and utilization;
- Quality of life; and
- Patient satisfaction.

Clinical pilot study

The e-dis system should:

- Have a **clinical outcome comparable to face-to-face therapy**.
- Reduce cost of treatment.
- Ease access to treatment.
- Increase adherence to treatment.
Clinical pilot study

- 9 patients with oropharyngeal dysphagia of neurological origin with no spontaneous recuperation.

- Patients were divided into two random groups each with different levels of severity but comparable dysphagia:
  - One group carried out the rehabilitation program for 10 days using e-dis with the recommendation of doing all exercises at least once a day.
  - Other group, the control one, will perform the conventional therapy program in the Department of PM&R at the Hospital de Sant Pau during 1 hour per 10 days.
Clinical pilot study

In all patients the following information was collected:

- **Diagnosis** and medical complications during last 3 months.

- **Specific dysphagia examination:** BMI, voice quality, cough with different food consistencies/textures, posture, oropharyngeal structures mobility and strength, apraxy, bolus fragmentation and feeding ability.

- **Scales used:**
  - Scale of Severity and Outcomes of Dysphagia
  - Euro-QOL-5D (EQ-5D).
  - SWAL-CARE.

- **Questionnaire of family involvement and satisfaction.**
Pt’s diagnosis and functional status

<table>
<thead>
<tr>
<th>e-dis</th>
<th>Face-to-face</th>
</tr>
</thead>
</table>
| ▪ PT 1 Atypical Parkinson.  
  *FIM 74/126* | ▪ PT 6: Atypical Parkinson.  
  *FIM 53/126* |
| ▪ PT 2 TBI.  
  *FIM 51/126* | ▪ PT 7 S/P Sx Meningioma.  
  *FIM 124/126* |
| ▪ **PT 3** S/P Intracranial hemorrhage 2ª aneurism rupture.  
  *FIM 29/126* | ▪ **PT 8** CVA R Hemiplegia.  
  *FIM 116/126* |
| ▪ **PT 4** CVA R Hemiplegia + Aphasia.  
  *FIM 88/126* | ▪ **PT 9** Oculopharyngeal dystrophy.  
  *FIM 124/126* |
| ▪ **PT 5** R Hemiplegia + Aphasia 2ª multiple embolizations 2ª AV malformations.  
  *FIM 73/126* | |
# Pt’s distribution according to The Dysphagia Outcome and Severity Scale

<table>
<thead>
<tr>
<th>Severity Scale</th>
<th>Face-to-face</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Level 7</strong> Normal in all situations</td>
<td></td>
</tr>
<tr>
<td><strong>Level 6</strong> Within functional limits/modified independence</td>
<td></td>
</tr>
<tr>
<td><strong>Level 5</strong> Mild dysphagia: Distant supervision, may need one diet consistency restricted</td>
<td>P9</td>
</tr>
<tr>
<td><strong>Level 4</strong> Mild–moderate dysphagia: Intermittent supervision/cueing, one or two consistencies restricted</td>
<td>P7-P8</td>
</tr>
<tr>
<td><strong>Level 3</strong> Moderate dysphagia: Total assist, supervision, or strategies, two or more diet consistencies restricted</td>
<td>P6</td>
</tr>
<tr>
<td><strong>Level 2</strong> Moderately severe dysphagia: Maximum assistance or use of strategies with partial P.O. only (tolerates at least one consistency safely with total use of strategies)</td>
<td>P3</td>
</tr>
<tr>
<td><strong>Level 1</strong> Severe dysphagia: NPO: Unable to tolerate any P.O. safely</td>
<td>P2</td>
</tr>
</tbody>
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Results from pilot study

Is the use of telemedicine system comparable to conventional therapy?
Results from pilot study

Is the use of telemedicine system comparable to conventional therapy?
Pilot Study Results: **Dysphagia Severity**

![Bar chart showing dysphagia severity for different patients. The x-axis represents patients 1 to 9, and the y-axis represents severity levels from 0 to 7. The chart compares initial and final severity levels for both e-dis and face-to-face interactions.](chart.png)
EQ-5D Personal Health Self-assessment

- **Five dimensions of health:**
  - Mobility
  - Personal care
  - Daily activities
  - Pain / discomfort and
  - Anxiety / depression

- **Each has three levels of severity:**
  - 1 no problems
  - 2 moderate problems or
  - 3 serious problems

- **Best health Indicator: 11111**
Pilot Study Results: 
Personal Health Self-assessment

EQ-5D Health State Calculation

Best health indicator 11111 = 1

If the health indicator is different from 1:

Subtract the value of the constant

If level 2 problems in a particular dimension, subtract the value for correspondent dimension.

If level 3 problems in a particular dimension subtract the value for correspondent dimension multiplied by 2 and the N3 parameter.

Constant= 0,1502
Mobility (M)= 0,0897
Personal Care (PC)= 0,1012
Daily activities (DA)= 0,0551
Pain/discomfort (PD) = 0,0596
Anxiety/depression (AD)= 0,0512
N3= 0,2119
Pilot Study Results:
General health perception

The best imaginable state of health

Your health today

The worst imaginable state of health
Pilot Study Results: **clinical changes**

<table>
<thead>
<tr>
<th>Voice</th>
<th>Meal time</th>
<th>Coughing up ingestion</th>
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<tbody>
<tr>
<td></td>
<td>Initial</td>
<td>Final</td>
</tr>
<tr>
<td>P1</td>
<td>wet</td>
<td>normal</td>
</tr>
<tr>
<td>P2</td>
<td>wet</td>
<td>wet</td>
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<tr>
<td>P3</td>
<td>wet</td>
<td>wet</td>
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<td>P5</td>
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<td>P6</td>
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<td>P7</td>
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<tr>
<td>P8</td>
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<td>normal</td>
</tr>
<tr>
<td>P9</td>
<td>normal</td>
<td>normal</td>
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</table>
## Pilot Study Results: **clinical changes**

<table>
<thead>
<tr>
<th></th>
<th>Drool</th>
<th>Liquids upside down</th>
<th>Lips with tongue encircle</th>
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</thead>
<tbody>
<tr>
<td>P1</td>
<td>Initial</td>
<td>Final</td>
<td>Initial</td>
</tr>
<tr>
<td>P2</td>
<td>YES</td>
<td>YES</td>
<td>NO</td>
</tr>
<tr>
<td>P3</td>
<td>YES</td>
<td>NO</td>
<td>NO</td>
</tr>
<tr>
<td>P4</td>
<td>NO</td>
<td>NO</td>
<td>YES</td>
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<td>P5</td>
<td>NO</td>
<td>NO</td>
<td>YES</td>
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<tr>
<td>P6</td>
<td>YES</td>
<td>NO</td>
<td>NO</td>
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<tr>
<td>P7</td>
<td>NO</td>
<td>NO</td>
<td>YES</td>
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<tr>
<td>P8</td>
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<tr>
<td>P9</td>
<td>NO</td>
<td>NO</td>
<td>YES</td>
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</table>
## Pilot Study Results: **clinical changes**

<table>
<thead>
<tr>
<th>Muscles of the tongue</th>
<th>Tipper</th>
<th>Propulsion</th>
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<tbody>
<tr>
<td>Initial</td>
<td>Final</td>
<td>Initial</td>
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<td>P2</td>
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<tr>
<td>P3</td>
<td>NORMAL</td>
<td>NORMAL</td>
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<tr>
<td>P4</td>
<td>NORMAL</td>
<td>NORMAL</td>
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<td>P5</td>
<td>AFFECTED</td>
<td>AFFECTED</td>
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<tr>
<td>P6</td>
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<td>AFFECTED</td>
<td>NORMAL</td>
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<td>P8</td>
<td>NORMAL</td>
<td>NORMAL</td>
</tr>
<tr>
<td>P9</td>
<td>AFFECTED</td>
<td>AFFECTED</td>
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</table>
## Pilot Study Results: Clinical Changes

<table>
<thead>
<tr>
<th></th>
<th>Swallow delay</th>
<th>Fragmentation of the bolus 5cc</th>
<th>Fragmentation of the bolus 10cc</th>
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<tbody>
<tr>
<td></td>
<td>Initial</td>
<td>Final</td>
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</tr>
<tr>
<td>P1</td>
<td>&lt;2&quot;</td>
<td>&lt; 2&quot;</td>
<td>2</td>
</tr>
<tr>
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<td>P3</td>
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<td>P5</td>
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<td>P6</td>
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<td>P7</td>
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<td>P8</td>
<td>&lt;2&quot;</td>
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<tr>
<td>P9</td>
<td>&lt;2&quot;</td>
<td>&lt; 2&quot;</td>
<td>NO</td>
</tr>
</tbody>
</table>
Patient satisfaction: **SWAL-CARE items**

- Had confidence in your swallowing clinicians.
- Swallowing clinicians explained treatment to you.
- Swallowing clinicians spent enough time with you.
- Swallowing clinicians put your needs first.

Pilot Study Results: **SWAL-CARE items**

- 100 indicates the most favorable and 0 the worst

<table>
<thead>
<tr>
<th></th>
<th>e-dis</th>
<th></th>
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<tbody>
<tr>
<td>Confidence</td>
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<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Treatment</td>
<td>1</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>Time</td>
<td>1</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>Needs</td>
<td>1</td>
<td>4</td>
<td></td>
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<table>
<thead>
<tr>
<th></th>
<th>Face-to-face</th>
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</thead>
<tbody>
<tr>
<td>Confidence</td>
<td>1</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Treatment</td>
<td></td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>Time</td>
<td>1</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Needs</td>
<td>1</td>
<td>3</td>
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</table>

Legend: 70 80 90 100
Pilot Study Results: **Patients Satisfaction**

- Metric scale of 0 to 10; 10 indicates the most favorable and 0 the worst

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**e-dis**

<table>
<thead>
<tr>
<th></th>
<th>0%</th>
<th>20%</th>
<th>40%</th>
<th>60%</th>
<th>80%</th>
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<tr>
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<td>1</td>
<td>3</td>
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<td>0</td>
</tr>
<tr>
<td>Saves Time</td>
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<td>2</td>
<td>2</td>
<td>0</td>
<td>0</td>
<td>0</td>
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</table>

**Face-to-face**

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<th></th>
<th>0%</th>
<th>20%</th>
<th>40%</th>
<th>60%</th>
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<th>100%</th>
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<td>1</td>
<td>1</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Saves Time</td>
<td>1</td>
<td>1</td>
<td>2</td>
<td>0</td>
<td>0</td>
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</table>
Pilot Study Results:

What about COST?
How much costs a dysphagic pt?

**Face-to-Face**

- Videofluoroscopy: 381,25 €
- Dysphagia clinical evaluation and treatment:
  - **Total cost: 146,80€ x pt**
- Transportation if needed x 15 days.

- Ambulance: 100€/way
- Assistance’s cost: 20 €/therapy time

**e-dis**

- Videofluoroscopy: 381,25 €
- Dysphagia clinical evaluation and treatment:
  - 19,57€ (2 inhospital visits).
  - 1 therapist / 2 pts: 63,61€
  - **Total cost: 83,18€ x pt**
- Transportation if needed x 2 days.

- Computer: 304,99€
- Modem + internet connection: 30€/month
Why Pt’s liked e-dis?

- It permits to do therapy any time of the day and every day.
- It’s “portable”.
- It makes possible family/caregiver’s participation.
- It reduces the cost of a ST.
- They have fun with it!
What have we learnt from Pt’s/families?

➡ Severe disable patients are not able to do all the exercises every day.

➡ Family/caregivers in severe disabled pt’s made good choices picking exercises.

➡ Pts and families/caregivers had a good time doing therapy.
What have we learnt from Pt’s/families?

“Fear” of technology:

- Decision of not to do therapy.
- Stress.
- Need of support from family/caregiver fully implicated in therapy.
What have we learnt from Therapist?

- The **video’s quality** permits a good evaluation of the exercise.
- The **visual and the written judgment of** the exercise allows comments.
- They can **control 2 pt’s per hour** if they do the full review of videos.
What have we learnt from Therapist?

The written feed-back from pts gives them the impression that the therapy is properly tracked.
CONCLUSIONS

Can be an alternative to a part of the conventional treatment: it’s equally effective.

Can be an efficient and cost/efficient alternative to the conventional treatment: it’s cheaper.

It needs patients/families with no technological fear and who are willing to actively participate in the therapy.
WHO MADE IT POSSIBLE

Doctors

- Helena Bascuñana
- Josep Mª Picas
- Gemma Garmendia

Engineers

- Josep Mª Monguet
- Berenice Blanco
- Edgar Castelán
- Eduardo Huerta
THANK YOU

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