# Time Flow Study Paper

Purpose: to analyze the efficiency of TEES

* Look up case reports on tympanoplasty (follow a case report layout)
  + Case report to also comment on the different steps
* Medline search on timing surgeries
* Inconsistencies in how procedures are performed -> the technique/approach varies
* Why underlay or interlay
* Mesh terms: time, time analysis

## Abstract:

## Background:

Focus on the inefficiencies in TEES in the background -> are there papers that say this is inefficient, case reports that vary in terms of technique, times, blood loss, outcomes, etc.

Condition of the patient, inefficiencies, using different tools

Rube et al. Recorded the time for MRI-guided angioplasty and assessed the efficiency and feasibility of the proposed workflow and framework for this type of procedure (Rube et al., 2015). Similarly in an attempt to show the efficiency of a dedicated minimally invasive operating room (OR), Hsiao et al. recorded the time for steps during laparoscopic procedures in two types of OR’s: a dedicated minimally invasive OR and a traditional OR (Hsiao, Machaidze, & Pattaras, 2004). A time flow study was also used to measure the patient wait times before and after restructuring the practice patterns to assess the efficiency of the new practice (Racine & Davidson, 2002). Time flow studies have been employed to analyze the efficiency and compare between surgery procedures and hospital protocols.

This study will also assess the feasibility and efficiency of endoscopic ear surgery using the same method: recording the times of steps in the procedure. This will aim to determine the inefficiencies and address the steps where further instrument design would be beneficial. This would also provide a good benchmark against which to measure efficiency and feasibility of future tools that would be developed. This will aim to measure the efficiency of current endoscopic ear surgery and provide areas where instrumentation redesign is required.

## Methods:

### Study Design:

The SickKids Research Ethics Board reviewed and approved the study. The participants for this observational study included four staff otologists from Toronto: three from SickKids and one from Toronto General Hospital. Each participant had more than <insert number of years> years of experience in TEES. Patients who were undergoing tympanoplasty or cholesteatoma removal surgery using TEES were included in the study. Ten (??) surgeries from each otologist were studied.

The duration of the following steps were recorded using a standard stopwatch: cleaning out the ear canal, injecting anaesthesia, trimming the hairs, cleaning edges of the perforation, making the skin incision, raising the tympanomeatal flap, preparing the graft, placing and positioning the graft, replacing the flap, packing the ear canal. If the case was a cholesteatoma removal, then the time to remove cholesteatoma was also recorded.

The type of instruments used during these different maneuvers and the number of changes between different instruments will also be noted. These observations will also lead to an appreciation of the ergonomic requirements of instruments during ear surgery and the design advantages of different instruments for specific maneuvers.

The variance in time-flow between cases was high between cases based on patient specific factors such as extent of bleeding, ear canal morphology and extent of disease. As well, often the surgeon was teaching a trainee how to perform the surgery; this contributed to longer durations of steps as the staff surgeon was not the only one operating. Nevertheless, this methodology provided a more accurate assessment of surgical practice and challenges than anecdotal surgeon’s recall. Steps demanding a disproportionate amount of time or multiple changes in instrument will be determined from analysis of these data. This will reveal procedural areas in which surgical efficiency may be improved by instrument modification.

Recorded the instrument changes for each step. If there is a frequent instrument change, can merge the two functionalities of that instrument into one to see if that would make that step easier. Can use the instrument changes to design the instrument.

Not in the line of sight of the surgeon so that they can’t see me and can focus on doing the surgery normally.

Hair trimmer – tried to make it easier (one handed) but this step already doesn’t take much time and so this wouldn’t save significant surgical time (insert the median time for trimming hairs).   
Graft placement tool – developed a graft pusher tool for capstone but the surgeon found that it became easier to place the graft with conventional instruments and didn’t need the graft placement tool

### Statistical Analysis:

The data was analyzed using the medians.

## Results:

## Discussion:

### Cleaning out ear canal:

The ear wax is cleaned out of the external auditory canal (EAC) so to avoid dirtying the lens of the endoscope every time the endoscope is introduced into the EAC. Suction and wax curette (sp??) are used for this.

### Inject Anaesthesia:

This step provides local anaesthetic into the EAC and helps to maintain hemostasis.

### Trim ear hairs:

This is another step to ensure the endoscope lens stays clean, as hairs can obstruct the visualization. This is a good training step for trainees to familiarize themselves with TEES and perform a simple yet important task. Scissors and middle ear scissors are used.

### Freshen the edges of the perforation:

Cutting around the edges of the perforation in the tympanic membrance, usually done with a knife or Rosen needle, allows the tympanic membrane to heal and the graft is used as a scaffold to facilitate this healing process. [source = top ten reasons or Jane Lea’s training paper – search scaffold or freshen perforation in mendeley].

### Making the skin incision

This is the incision used to raise the tympanomeatal flap. Round knife or suction round knife is used.

### Raising the tympanomeatal flap

According to Lea and Mijovic, raising the tympanomeatal flap is the most challenging and bloodiest step of surgery (Mijovic & Lea, 2015). Panetti suction instruments – suction right, left, round knife are used, with cotton balls soaked in epinephrine to maintain hemostasis, forceps to take tissue off of structures, i.e. the malleus while dissecting the tympanic membrane layers. The length of this step ranges and this is due to trainee involvement, and graft positioning technique – interlay vs. underlay which may require separation of tympanic membrane layers.

In tympanoplasty, the choice of the approach, graft material and graft placement technique depend on training, case load, resources and experience (James, Papsin, & Papsin, 2012). The choice of underlay, interlay or overlay graft placement can affect the raising of the tympanomeatal flap because during interlay, the layers of the tympanic membrane must be separated which would take longer.

### Preparing Graft

Look up case reports/case studies that would list the different grafts used.

The graft can be a synthetic/animal derived graft, patient’s fascia or cartilage.

### Placing and positioning the Graft

Graft placement techniques:

* Underlay =
* Interlay = separating the layers of the tympanic membrane
* Lateral = cutting a slit in the top of the graft and placing it around the handle of the malleus

### Replacing the Flap

The tympanomeatal flap is replaced. Derlacki, Rosen,

### Packing the ear canal

## Conclusion:

## References:

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