Abstract—The Harmonic scalpel is a scalpel designed to use ultrasonic technology to create incisions and coagulate the blood as the scalpel does so. The scalpel can vibrate at a rate of 55000 cycles per second [1]. The scalpel is FDA approved for areas with blood vessels within 5 mm in diameter and has been tested in different surgical treatments. Two such studies included testing the scalpel is surgeries involving cancerous tumors in the gastrointestinal tract and dissections in the neck of patients.

I. INTRODUCTION

The harmonic scalpel is designed for use in surgeries in order to reduce blood loss and reduce the time that a surgery would conventionally take. The blade of the scalpel vibrates at a rate of 55000 cycles per second in order to break down proteins in the blood, as it cuts into a tissue, in order to make the blood coagulate [1]. The scalpel has an operation temperature between 50-100 degrees Celsius while other electronic based scalpels operate from 150-400 degrees Celsius [1]. The blade is also changeable to use different configurations, depending upon the operation that needs to be performed. The Harmonic scalpel (figure 1 [2]) has also been FDA approved for use in surgery on vessels with a diameter under 5 mm [1].

II. STUDIES

Two studies, that shall be discussed, were conducted in order to compare the Harmonic scalpel with other scalpels, including electric and conventional methods, in two different surgeries. The first study was the use of the Harmonic scalpel in gastrectomy in cases of cancer of the colon (gastrectomy is the removal of a segment of the colon). The study was conducted between 19 different sub-studies that included 1930 patients, 946 were operated on with the Harmonic scalpel and 984 conventionally, undergoing the procedure [3]. The second study involved dissection and removal of tumors in the neck involving head and neck cancers. The study compared the use of conventional scalpels to the Harmonic scalpel and involved 406 cases of surgery, where 201 of them were done with the Harmonic scalpel [4].

III. RESULTS

The purpose of the two studies was to compare and contrast the figures of the Harmonic scalpel vs conventional steel scalpels. The areas of comparison include, and are not limited to: blood loss during surgery, duration of surgery, postoperative complications frequency, recovery time, drainage, and in the colon cases, lymph dissections, the key comparisons being blood loss, postoperative complications and surgery duration. The Harmonic scalpel, in both cases, reduced blood loss by approximately 50% over the conventional method (figure 2), comparison being around 200 mL conventionally to around 110 mL with the Harmonic scalpel [3]. The surgery duration was reduced by around 30 minutes between the conventional methods and the Harmonic scalpel [4]. The operation times were reduced from around 80 minutes, in some cases, from around 120-150 minutes in the conventional cases (figure 3) [4].

IV. DISCUSSION

The Harmonic scalpel appears to be more efficient and had increased statistics over the conventional methods. One problem with the scalpel is that there is some thermal damage around the targeted area due to the energy that the blade has building heat and damaging tissue [3], however this is less than other methods that are not the steel scalpel due to lower operational temperatures. The Harmonic scalpel is more efficient in the treatment of cancers that can be removed via surgery due to the coagulation around the incisions thus preventing blood loss and the potential breaking and metastasizing of the tumor through the blood flow. The Harmonic scalpel’s statistics are vastly better than the conventional methods in these studies and can be proven to be more efficient in other conditions.

REFERENCES