ON THE EFFICACY OF ANCIENT EGYPTIAN SURGICAL TECHNIQUES

An Undergraduate Research Scholars Thesis

by

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Submitted to the Undergraduate Research Scholars program at
Texas A&M University
in partial fulfillment of the requirements for the designation as an

UNDERGRADUATE RESEARCH SCHOLAR

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May 2020

Major: Biomedical Engineering

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ABSTRACT

On the Efficacy of Ancient Egyptian Surgical Techniques

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Literature Review

There are many writings about ancient Egyptian medical papyri, but none examine whether doctors now can effectively treat more injuries than doctors learning from those papyri. There have been some analyses looking at the pharmaceuticals mentioned in the papyri, which determined what substances are still in use today, and this project takes a similar approach to surgical treatments for injuries. This analysis uses translations of the medical papyri and books written on pharaonic medicine based on papyri, tomb paintings, and bioarcheological evidence to determine how many injuries ancient doctors could effectively treat and then compares that to current practices to see whether modern surgeons can treat a higher proportion of the injuries they encounter.

Thesis Statement

Existing medical papyri pertaining to injuries supply information on how surgeons in pharaonic Egypt would have treated patients. Judging by the ratio of effective to ineffective

treatments known from the papyri, were those surgeons able to treat as large a proportion of injuries encountered as modern doctors?

Theoretical Framework

This will be written through a historical framework, looking holistically at the two societies and acknowledging that they are at different stages of technological advancement and have differing levels of scientific knowledge. It will use statistics to try to answer the question of whether ancient surgeons could effectively treat as many injuries as modern surgeons by establishing ratios of effective to ineffective treatments from both times and comparing the ratios.

Project Description

Little evidence exists regarding medical treatments from the Old, Middle, and New Kingdoms of pharaonic Egypt (c. 2686 – c. 1070 BC), but there are some existing papyri written during that time period that contain instructions for ancient surgeons on how to treat injuries. One of the best known of these is the Edwin Smith papyrus, which documents 48 different types of injuries and how the surgeon should respond to each one. This papyrus is also unique in taking a scientific approach to the injuries and describing methods of treatment that do not involve magic. Using a translation of the Edwin Smith papyrus and articles describing the efficacy of individual treatments written in it, this project will build on existing research declaring the treatments' usefulness to instead determine the doctors' ability to treat a large proportion of the injuries they encountered.

This project will look at the Edwin Smith papyrus to determine whether the treatments listed would have helped the patient or not, either by being neutral or being actively harmful. Then that ratio of effective to ineffective treatments will be compared to a corresponding ratio of

modern practices for treating the injuries described. Using a Fisher's Exact Test to analyze these ratios will determine whether there is a statistically significant difference between the ratio of helpful to unhelpful treatments known to be taught to ancient Egyptian physicians and treatments performed by modern surgeons. If there is no such difference, then it must be concluded that ancient surgeons were effective at treating injuries they encountered in a similar proportion to doctors today based on what we know about ancient treatments and the Egyptians should be acknowledged for that fact.

DEDICATION

This paper is dedicated to my parents, David and Leigh Ann Dishman, who have always been there to offer support and encouragement, and to my brother, Matthew, who never fails to make me smile.

ACKNOWLEDGMENTS

I would like to thank my faculty mentor, Dr. Shelley Wachsmann, for his guidance and support throughout the course of this research.

Thanks also go to the members of Anthropology Society for making me feel welcome in a department outside my major. I also want to thank all my friends and the faculty and staff of both the Biomedical Engineering and Anthropology departments for making my time at Texas A&M University such a great experience both in and out of the classroom.

Finally, thanks to my mom and dad for their encouragement and to my brother for inspiring me to pursue my passions.

KEY WORDS

ESP Edwin Smith papyrus

INTRODUCTION

The scientific approach to medicine that is used today is generally attributed to the Greeks, especially Hippocrates, but there is evidence of a scientific approach in Egypt over a millennium prior that is not as widely known. The ancient Egyptians wrote on papyrus and some medical papyri have survived. The Egyptian culture was generally not open to change, adopting an attitude that if something had worked for people previously, then there was no reason to change it. An example of this is the fact that the medical texts were seen as sacred and physicians were expected to stick to those treatments instead of trying their own ideas, at least for the first four days of treatment, after which they could alter their prescription.[1] If the physician treated the patient as per the texts then they could not be blamed if the patient died, as the Egyptians thought no one could know better than the oldest practitioners that wrote the texts they used, but if they did not follow the directions and the patient died, then they were put on trial with the possible penalty of death.[2] This idea of not changing past practices can be seen not only in medicine, but also art from the Early Dynastic Period through the New Kingdom (c. 3100 BC – c. 1070 BC).[3] Thus, many of the papyri that still exist are thought to be copied from older texts, so dating when exactly the information in them was first written down can be difficult.

There are currently ten surviving major medical papyri.[4] The most notable of these related to treating injuries is the Edwin Smith papyrus (ESP) which was written circa 1600 BC, though it is widely agreed that it is a copy of a much older text.[5] It is possible that the original

[1] Aristotle, 3:1286a (Loeb, 21:256-257).
[2] Diodorus Siculus, 1.82 (Loeb, 1:280-283).
[3] Brawanski 2012, 2288.
[4] Brawanski 2012, 2285.
[5] Breasted 1930, 3.

source of the ESP was written as far back as 3000 BC and was simply copied by scribes for successive centuries until around the 17th century BC when a scribe made the copy that survives today.[6] That scribe also added commentaries to the papyrus to clarify old expressions or words that were no longer in use, which has proven extremely helpful in translating the ESP since so many of the words in it are not found anywhere else in ancient Egyptian literature.[7] The ESP is composed of 377 lines on the front, or recto, that comprise a surgical treatise, making it the oldest such treatise known.[8] The back, or verso, contains 92 lines and comprises exclusively of recipes and incantations.[9]

Magical incantations and recipes were commonplace in ancient Egyptian medicine. There were generally three types of physicians: *swnw*, *wab*, and *sau*.[10] *Swnw* was the word for physician and used for those that were trained in scientific treatments, like those written on the recto of the ESP. *Wab* was the word for priests of the goddess Sekhmet. They were considered healers because she was the associated with plagues brought by her messengers and, therefore, was called on for protection from disease.[11] The word *sau* is translated to magician, but it usually refers specifically to magicians in the cult of Serket, the scorpion goddess, because the clergy of that cult were all healers trained in magic who would be called upon to treat illness with spells and amulets.[12] As seen by the types of physicians recognized in ancient Egypt, magic was expected to treat ailments more than science, and the ESP is actually a rare case of having

[6] Breasted 1930, 19.
[7] Breasted 1930, 19.
[8] Breasted 1930, 6.
[9] Breasted 1930, 5.
[10] Halioua, Ziskind, and Redford 2005, 7.
[11] Shaw 2014, 26.
[12] Ancient History Encyclopedia, s.v. “Serket”.

minimal magical remedies; out of the 48 cases preserved in the treatise on the recto, only one resorts to magic while the rest are analytical and scientific in their treatment.[13]

Because the ESP is the only medical papyrus that is a surgical treatise and looks at physical treatments for cases instead of recipes or incantations for ailments of all kinds, it is the only papyrus that will be examined to determine ancient Egyptian physicians' surgical efficacy. This thesis will examine each of the 47 complete cases present in the treatise and determine the efficacy of the physician's treatment then compare that to modern treatments for the same injuries.

[13] Breasted 1930, 6.

CHAPTER I

ANCIENT TREATMENTS

The Edwin Smith papyrus (ESP) is organized by cases, listing 48 different cases that might be brought before a physician, going from the head down to the chest before the papyrus ends in the middle of Case 48. The cases are not physically divided on the page, but there are distinct groups of cases listed together. These groups are divided by Breasted into the head, the throat and neck, the clavicle, the humerus, the sternum, overlying soft tissue, and true ribs, the shoulders, and the spinal column at which point the papyrus ends, leaving it incomplete.[14] There is also order within each group of cases as the author of the ESP lists the injuries from least severe to most severe.[15] Each case describes the symptoms seen in the patient and then directs the physician to give one of three verdicts for the case: "An ailment which I will treat," "An ailment with which I will contend," and "An ailment not to be treated."[16] The first verdict listed is found outside the ESP in nineteen instances.[17] The second verdict is found only in the ESP and the Ebers papyrus, and it only appears twice in Ebers.[18] The third verdict, “an ailment not to be treated” is unique to the ESP.[19] The cases with this verdict also show that the surgeon writing the ESP recorded symptoms for cases that they could not treat, which demonstrates an interest in learning beyond what was immediately useful, a type of thinking that is not seen anywhere else in ancient Egyptian documents.[20]

[14] Breasted 1930, 33.
[15] Breasted 1930, 35.
[16] Breasted 1930, 46.
[17] Breasted 1930, 95.
[18] Breasted 1930, 148.
[19] Breasted 1930, 6.
[20] Breasted 1930, 160.

The structure of each case also maintains an order that is followed in all 48 cases, with six cases having more elaboration to them.[21] Each case has five sections: Title, Examination, Diagnosis, Treatment, unless it was a fatal case, which was considered untreatable, and Glosses, which are explanations added by the scribe of this papyrus to clarify any obscure terms or idioms.[22]

Injuries Found in the Edwin Smith Papyrus

Breasted divided the ESP into seven groups of similar cases as a way to better see the order the scribe had when writing these instructions. User Sinuhe20 created a diagram that illustrates the locations of these cases, but there are more locations than just the seven groups Breasted used because they were more specific in their groupings (Fig. 1). Table 1 contains a list of the case number groups seen in Figure 1 and their locations on the body. A more detailed look at each individual case can be found in Table 2 in Appendix A. Because of the system of verdicts given and the listing of injuries from least to greatest severity within each group, the papyrus could also be interpreted as the earliest evidence of triage, where the physician prioritized the injuries by severity.[23] This could have been a useful tool for a surgeon on a battlefield, where many of the injuries listed were likely to occur. There are more injuries listed in the ESP than just 48, however. Some injuries contain multiple examinations for the physician to go through, and, depending on the results of those examinations, the injury could lead to different outcomes. This gives a total of 57 different injuries in the ESP.

[21] Breasted 1930, 36.
[22] Breasted 1930, 36, 10.
[23] Estes 1989, 62.

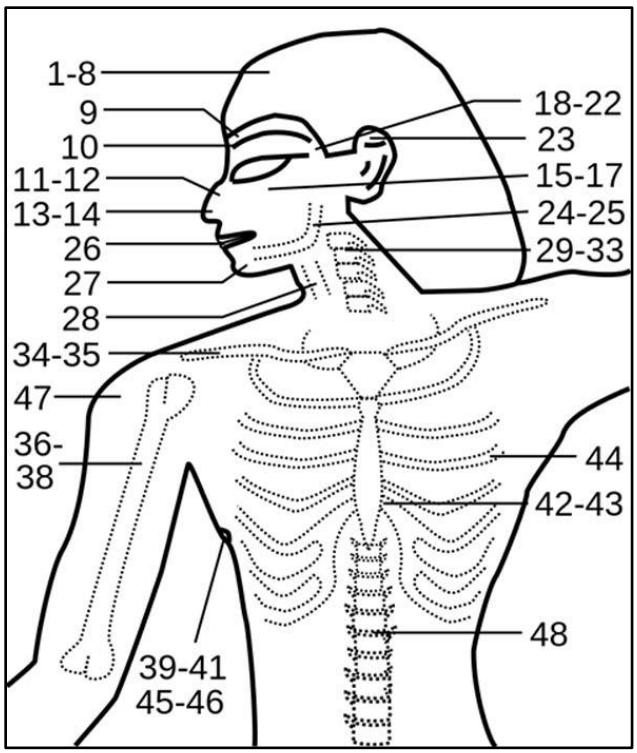

Figure 1. *The Edwin Smith Papyrus Anatomical Distribution of Cases.* Diagram showing the location of all injury locations listed in the Edwin Smith papyrus and corresponding case numbers. (Figure courtesy of Sinuhe20. Border added by author. CC BY-SA 3.0)

Table 1. *Grouping Cases in the Edwin Smith Papyrus by Location of Injury*

Case Numbers	**Location of Injury**	**Case Numbers**	**Location of Injury**
1-8	Skull	27	Chin
9	Forehead	28	Neck
10	Eyebrow	29-33	Cervical Vertebrae
11-12	Nasal bone	34-35	Clavicle
13-14	Nose	36-38	Humerus
15-17	Cheek	39-41, 45-46	Chest
18-22	Temple	42-43	Sternum
23	Ear	44	Ribs
24-25	Mandible	47	Shoulder
26	Lips	48	Spinal vertebrae

Efficacy of Ancient Treatments

The treatments found in the ESP contain many types of injuries, ranging from superficial to severe. Unfortunately, despite the fact that there is more space for text, the 48th case ends in the middle of the treatment, so there is no way to correctly assess it and it was not included in this research, leaving only 56 injuries to be evaluated. The treatments were all analyzed according to the type of injury and what modern medical techniques are considered effective. For a list of cases with details on the injuries and treatments, see Table 2 in Appendix A. Many of the treatments in the ESP repeat because the structured form of the treatise has some cases that are the same wound but in a different location, so it is a different case, and these often times have the same treatment associated with them.[24] Due to this repetition, the cases will be evaluated in groups of similar treatments first and then unique cases will be examined.

The first group of injuries evaluated were incised slashing and piercing wounds, such as swords in battle. There are 21 injuries in the ESP that fall in this group. For all of these flesh wounds, injuries that cut through skin but not all the way into bone, the initial prescription is bandaging the wound with fresh meat on the first day. This was an effective treatment because fresh meat can provide blood clotting factors, aiding the clotting process and speeding up the healing of the wound.[25] Then the prescriptions almost invariably follow the same order of binding the wound with grease, honey, and linen bandages. This could improve healing via multiple mechanisms. First, the linen bandages used would draw moisture, including lymph, away from the wound to reduce swelling.[26] Lymph is a clear fluid that contains white blood cells, which fight infection, and thus lymph gets directed to wounds as part of the immune response

[24] Breasted 1930, 89.
[25] Nunn 1996, 150.
[26] Wade 2017, 52.

and the excess fluid causes swelling which can cause discomfort for the patient. Ancient Egyptian bandages were of such high quality, they only marginally fail today's British Pharmacopoeia standard for cloth bandages despite being handmade.[27] The grease, or oil, was used as a barrier to protect and soothe the wound.[28] The honey was useful for multiple reasons. Since honey is filled with sugars, it would have an osmotic effect on the wound and draw out moisture, further reducing swelling and inflammation.[29] Honey is also useful because it is bacteriostatic, meaning bacteria cannot undergo cell division while in a matrix of honey.[30] This inhibiting effect has been shown to extend to the most common cause of wound infection, *Staphylococcus aureus*, which was inhibited by relatively low concentrations of honey.[31] Studies have also found that even antibiotic-resistant bacteria are susceptible to having cell division inhibited by honey.[32] All of this modern evidence shows that for flesh wounds, the treatment given was able to help the patient heal and, therefore, is determined to be effective.

In addition to the treatment of fresh meat, grease, and honey, seven of the cases have instructions for stitching the wound closed. The first one to mention it is Case 10, which Breasted says has "a surgical suture, the earliest known reference to sewing up a wound in the history of surgery."[33] Also, with the exception of anesthesia being used now, the general practice of stitching up a wound and then treating it has not really changed from ancient Egypt to today.[34] This begs the question of why the ancient Egyptians used sutures so rarely if they were

[27] Campbell, Campbell, and David 2005, 67. British Pharmacopoeia provides official standards for medicines in the UK and the Commonwealth, as well as being used in over 100 countries and providing expert advice to the European Pharmacopoeia and the World Health Organization.
[28] Wade 2017, 52.
[29] Nunn 1996, 150.
[30] Wade 2017, 52.
[31] Seckam and Cooper 2013, 21.
[32] Seckam and Cooper 2013, 21.
[33] Breasted 1930, 230.
[34] Wade 2017, 50.

competent at using them. The oldest surviving sewing needles are predynastic, and they were clearly capable of using them by the Early Dynastic Period, but the word for "sewing" is extremely uncommon, with only a couple instances, and the word for "sew" used in the ESP is only seen in this papyrus.[35] There is also no trace of surgical suturing in any mummy, though embalmers in the XXVIth Dynasty did use sutures after death to close the incision they made to remove the internal organs.[36]

The next group is spinal injuries. Since the ESP cuts off in the middle of the last case, which is a spinal column injury, the only spinal injuries evaluated were injuries to the cervical, or neck, vertebrae. These are found in Cases 29-33. Of these, only Case 29 describes an open injury, which is treated with fresh meat like other open wounds. That would have helped the blood to clot, which is an effective treatment for an open wound. Cases 30-33 are all closed injuries with varying degrees of severity based on whether they affect the spinal cord.[37] Cases 30 and 32 receive verdict 1, with the physician thinking they can heal the patient. Both of these treatments would have been effective at treating the patient, because both involve stabilizing the patient's neck by binding it, and that is a large part of the nonoperative treatment for sprains and displacements of cervical vertebrae.[38] Cases 31 and 33, however, are given verdict 3 and no treatment is given because the spinal cord has been injured and the patient cannot feel, or move, their arms or legs.[39]

Four cases deal with the nose. Cases 11 through 13 deal with different breaks to the nose and Case 14 is for a wound to the nose penetrating to the nostril. Cases 11 and 12 both prescribe

[35] Nunn 1996, 172.
[36] Nunn 1996, 172.
[37] van Middendorp, Sanchez, and Burridge 2010, 1818.
[38] Spoonamore.
[39] van Middendorp, Sanchez, and Burridge 2010, 1818.

cleaning the broken nose out with linen swabs to remove all coagulated blood, then using stiff rolls of linen to hold the nose straight, which is an effective treatment for a broken nose.[40] Case 13, unfortunately, tells the surgeon not to treat the injury and, therefore, gives no treatment. Finally, Case 14 is already covered as one of the wounds treated with stitches, honey, and linen bandages, but it also mentions cleaning out the nose with linen swabs. All of the treatments suggested are effective and use principles that are still seen in modern treatments for setting the nose and helping it to heal correctly.[41]

Having covered the groups, now let us look at the cases on an individual basis. Case 4 is a wound that splits the skull and, judging from the description given, is probably a linear fracture. The treatment is to keep the patient going about their life as normal, but require them to stay sitting upright, which is an effective treatment since most linear fractures heal on their own and keeping the head elevated has been shown to help with traumatic brain injuries, which may occur in an injury that causes the skull to fracture.[42] Case 10 is a wound over the eyebrow that goes to the bone. This has already been mentioned as being treated with stitches and honey, but here the text also mentions that if the stitching comes loose, the surgeon is to draw the wound together with two strips of plaster, which is similar to modern day adhesive strips that are used sometimes instead of sutures.[43] Lower on the patient's head, Case 25 is a treatment for a dislocated mandible. The ESP's treatment for this injury is actually so effective that it is still in use today.[44]

[40] Meltzer and Sanchez 2012, 113, 119.
[41] Meltzer and Sanchez 2012, 113.
[42] Johns Hopkins Medicine; Winkelman 2000, 373.
[43] Meltzer and Sanchez 2012, 106.
[44] Forshaw 2015, 693.

The first case of an injury below the patient's throat is the first examination of Case 34, a dislocation of two clavicles that do not rupture the skin. The treatment to push the bones back into their places and bind them with stiff rolls of linen is an effective treatment because it sets the bones and stabilizes them, which is important in preventing re-dislocation.[45] Case 35 is similar to Case 34 as it treats a fracture of the two clavicles. This is treated by having the patient lie down and spreading out their arms to help the surgeon set the bones back into place. This is followed with using linen splints on the arm to stabilize the shoulder, which is an effective way of helping the clavicles heal back together.[46] Another fracture is mentioned in Case 36, this time of the humerus. The treatment is virtually identical to Case 35, except the shoulders are stretched to help straighten the arm to set the bone back into place. Though there is no specific standardized treatment today, this is an acceptable way to treat many fractures to the humerus because it is still a closed injury, so setting the bone back into place and immobilizing it is considered effective.[47] Case 39 refers to tumors or ulcers in the chest that might have been caused by injury. This is an interesting case because the treatment calls for using a fire-drill, a tool used for starting fires, to burn the tumors and treating the sores with wound treatment, probably an anti-inflammatory medicine. This is an effective procedure because it allows the wounds to drain and cauterizes them to prevent further illness from them.[48] Case 42 is a treatment for a sprain of the ribs which, along with Case 43, a dislocation of the ribs, is given an effective treatment: binding the injury and treating with honey. The honey does not do much here, but binding the ribs would

[45] Morell and Thyagarajan 2016, 247.
[46] Paladini et al. 2012, 50.
[47] Burkhart et al. 2013, 592-93.
[48] Campbell 2007, 566.

help them heal because it would supply support and prevent them from shifting as the patient moves.[49]

Cases 41 and 46 are both intriguing because they contain detailed treatments that call for various applications, but are different than recipes seen elsewhere because there is no magic involved and the recipes appear to be, for the most part at least, scientifically sound and effective as treatments for their respective cases.[50] In Case 41, willow leaves are the first thing to be applied, and they contain a natural precursor, salicin, to the active ingredient of Aspirin, acetylsalicylic acid, so they would be useful as pain and fever relief.[51] Then the treatment calls for a green pigment powder, which could be referring to malachite, which was used as a pigment in ancient Egypt and is an effective biocide, so it would have acted as an antibiotic agent.[52] This is important because Case 41 is treating an infected wound in the chest, so applying something to kill pathogens would be an effective treatment. Case 46 treats an abscess in the chest, and also has an effective treatment for it. It instructs the surgeon to make sure all the fluid in the abscess is drained out, and again calls for green pigment powder, probably malachite, among other things. Malachite is astringent, so it would be extremely helpful at constricting the skin around the abscess and keeping it from returning once it drained.[53] It is also, as already noted, a biocide, and the antibiotic properties would have been useful here as well.

Another group of injuries in the papyrus consists of those for which no effective treatments are given. There are 21 such injuries, 14 of which are given verdict 3, meaning a surgeon should not treat them. Case 17 is actually given verdict 3 most likely by mistake, since

[49] Campbell 2007, 567.
[50] Campbell 2007, 567-68.
[51] Norn et al. 2009.
[52] Harris 2016, 151.
[53] Campbell 2007, 568.

there is a treatment given for it that is effective, while Case 34 has one of its examinations give verdict 1 where verdict 3 should probably have been given, since it does not give any treatment following that.[54] Of the seven remaining injuries that were given treatments, most of them were solely to have the patient continue their regular life when intervention was necessary. Some, like Case 7, focus on treating the symptoms of the injury, but do not treat the cause. Case 7 actually probably shows someone suffering from different stages of tetanus due to an infected head injury. Unfortunately, none of the treatments involve treating the injury, they all focus on helping the person get motion back as their muscles seize up. One other ineffective case of note is Case 9, which is an anomaly in the ESP because it involves a scientifically useless recipe for a poultice and a magic charm to try to heal an injury. This is obviously ineffective, and it is not clear why it was added into a treatise of otherwise sound treatments and observations.

Overall, the ESP contains 56 injuries that were evaluated, and 35 were found to be effective, with 21 ineffective. This large number of ineffective treatments is mostly due to the fact that ancient Egyptian surgeons would refuse to treat some injuries that they knew were fatal. However, they were still able to effectively treat a majority of injuries they encountered based on current practice. These were not all the injuries that ancient Egyptian physicians could treat; the last injury in the papyrus is incomplete, and since it was methodically travelling down the body there were still likely many lower body injuries that would have had instructions for treatment.

[54] Breasted 1930, 269, 346.

CHAPTER II

CURRENT TREATMENTS

Knowing how effective each ancient treatment was is helpful and adds to the body of knowledge for the Egyptian medical papyri, and the Edwin Smith papyrus (ESP) in particular. However, in order to better understand the results found in this research, perspective is important. In order to understand the efficacy of ancient surgeons, a comparison with modern surgeons is desired. This supplies a benchmark against which to measure and showcases which injuries can now be treated that could not be treated in ancient times. In order to compare the two groups effectively, the same injuries will be investigated, and the modern treatments will be found and evaluated the same way.

Injuries Found in the Edwin Smith Papyrus

The ESP contains 47 cases that were investigated for this research. Case 48 was not considered because it is incomplete and does not supply a treatment. Table 2 in Appendix A contains a full list of cases, their verdicts, their treatments, and their efficacy. A simplified version can be seen in Table 3, showing the case number and a short description of the injury for all 47 cases used. These 47 cases provide 56 possible treatments that were evaluated for their effectiveness due to the possibility of each case having multiple examinations and different pathways along which the injury could progress.

Table 3. *Injuries in the Edwin Smith Papyrus by Case Number*

Case Number	Injury Description
1	A Wound in the Head, Penetrating to the Bone
2	A Gaping Wound in the Head, Penetrating to the Bone

Table 3. Continued

Case Number	Injury Description
3	A Gaping Wound in the Head, Penetrating to the Bone and Perforating the Skull
4	A Gaping Wound in the Head, Penetrating to the Bone and Splitting the Skull
5	A Gaping Wound in the Head with Compound Comminuted Fracture of the Skull
6	A Gaping Wound in the Head with Compound Comminuted Fracture of the Skull and Rupture of the Meningeal Membranes
7	A Gaping Wound in the Head, Penetrating to the Bone and Perforating the Sutures
8	Compound Comminuted Fracture of the Skull Displaying no Visible External Injury
9	Compound Comminuted Fracture of the Skull Displaying no Visible External Injury
10	Gaping Wound at the Top of the Eyebrow, Penetrating to the Bone
11	A Broken Nose
12	A Break in the Nasal Bone
13	Compound Comminuted Fracture in the Side of the Nose
14	Flesh Wound in One Side of the Nose Penetrating to the Nostril
15	Perforation of the Bone in the Region of the Maxilla and Zygoma
16	Split of the Bone in the Region of the Maxilla and Zygoma

Table 3. Continued

Case Number	Injury Description
17	Compound Comminuted Fracture of the Bone in the Region of the Maxilla and Zygoma
18	Wound in the Soft Tissue of the Temple, the Bone Being Uninjured
19	Perforation in the Temple
20	Wound in the Temple Perforating the Bone
21	A Split in the Temporal Bone
22	Compound Comminuted Fracture of the Temporal Bone
23	Slit in the Outer Ear
24	Fracture of the Mandible
25	Dislocation of the Mandible
26	Wound in the Upper Lip
27	Gaping Wound in the Chin
28	Gaping Wound in the Throat Penetrating to the Gullet
29	Gaping Wound in a Cervical Vertebra
30	Sprain in Cervical Vertebrae
31	Dislocation of a Cervical Vertebra
32	Displacement of a Cervical Vertebra
33	Crushed Cervical Vertebra
34	Dislocation of the Two Clavicles
35	Fracture of the two Clavicles
36	Fracture of the Humerus

Table 3. Continued

Case Number	Injury Description
37	Fracture of the Humerus with Rupture of Overlying Soft Tissue
38	Split in the Humerus
39	Tumors or Ulcers in the Breast Perhaps Resulting from Injury
40	Wound in the Breast
41	Infected or Possibly Necrotic Wound in the Breast
42	Sprain of the Sterno-Costal Articulations
43	Dislocation of the Sterno-Costal Articulations
44	Fractured Ribs
45	Bulging Tumors on the Breast
46	Abscess with Prominent Head on the Breast
47	Gaping Wound in the Shoulder

Note: Injury descriptions from Breasted 1930, 33-35.

Efficacy of Modern Treatments

Modern medicine has come a long way from what is seen in the ESP. Due to discoveries like antibiotics and medical imaging techniques, and a more complete understanding of body mechanics, modern surgeons are able to treat more injuries better than their ancient counterparts. In fact, every injury found in the ESP can be treated today with some degree of efficacy, though some still do not always lead to a successful recovery. Every injury that could be effectively treated in the ESP, however, can still be treated effectively with modern methods. The difference in the number of injuries that are able to be treated comes from all the treatments that either got verdict 3 in the ESP, mentioning no treatment, or had an ineffective treatment. There are 21 such

injuries, and they will be briefly analyzed to substantiate that there are modern treatments that work for such injuries.

In addition to the wound to the skin or bone, injuries to the head can cause brain damage. That is a reason why many of the cases that ancient surgeons found untreatable related to the head. Of the 21 injuries that were ineffective in the ESP, 13 are relating to the head. Case 5 describes a large open wound to the head with a skull fracture consisting of more than three pieces. This can be treated now with bone fragment replacement, sutures, and antibiotics.[55] Case 6 is similar, but with the meningeal membranes, the membranes that surround the brain and fill the space between it and the inside of the skull, being ruptured. This case can also be treated now by opening the skull until the brain stops swelling and removing the fragmentary bone before closing it back up and treating with antibiotics.[56] Case 7 is a head injury as well, and from the symptoms presented it presumably shows a case of tetanus infection of the injury. There are three different examinations in Case 7 depending on what symptoms are present, which is why modern physicians agree that it is probably indicating tetanus.[57] There is no complete cure for tetanus in modern medicine, but there are still treatments for it that work to keep the patient alive until the infection goes away. Ancient treatments were unable to effectively treat tetanus because they did not know to address the root of the problem, the injury.[58] Case 8 displays two examinations for a compound fracture of the skull without visible external injury, both of which are treatable now, but were not to the ancient Egyptians.[59] Case 9 is the same injury as Case 8, so it too can be treated with modern methods, but in the ESP it is treated with a magic recipe that

[55] Bullock et al. 2006, S56.
[56] AANS 2004.
[57] Breasted 1930, 176.
[58] CDC 2020.
[59] AANS 2004.

would have no therapeutic merit.[60] Case 13 is a compound fracture of the nose that can be treated now with modern surgical techniques.[61] Case 20 has a treatment in the ESP, but it does not actually help to cure the patient. This case, a wound to the temple that perforates the bone, is still one that can only be treated with limited success today.[62] Cases 21 and 22 both also deal with fractures to the temporal bone, and both can be treated with modern methods.[63] The last injury to the head that is not treated in the ESP, but can be treated now is Case 24, a fracture of the mandible. Today there are many ways to treat a fractured mandible depending on the location of the break, its severity, and the patient's age.[64]

From the head, the ESP moves to the neck, where three more injuries that have ineffective treatments in the ESP can now be treated. Case 28 has two examinations. The first one is effective, but the second one is not because it mentions the patient continuing to have a fever, and does nothing for them. Today there are medicines to reduce fevers, so that they can be treated effectively. The other two neck injuries that can only be treated with modern techniques are Cases 31 and 33: a dislocated cervical vertebra and a crushed cervical vertebra. Both of these can be treated effectively today, but the treatments, especially for Case 33, are not guaranteed to always work.[65]

Further down the body, Case 34 has an ineffective treatment, with the patient's collarbones dislocating and rupturing the tissue above them. This can be treated now with open surgery and wires holding the bone back together.[66] Case 37 is a fracture of the humerus with a wound cutting down to the bone, an injury which can be treated now using Open Reduction

[60] AANS 2004.
[61] Koh et al. 2016, 652.
[62] Sanchez and Burridge 2007, 8.
[63] Patel and Groppo 2010, 111-12.
[64] Koshy et al. 2010, 360-363.
[65] van Middendorp, Sanchez, and Burridge 2010, 1820.
[66] Beck.

Internal Fixation (ORIF).[67] ORIF is a method in which the bone is repositioned surgically, by cutting open the skin to set it, and then held in place with some way to physically reconnect the bones, such as a metal plate and screws. In Case 44, a case of fractured ribs, the injury in the ESP is not to be treated, but this injury can now be remedied with plates and screws holding the ribs together while they heal.[68] An interesting injury in the ESP is Case 45, which describes bulging tumors on the patient's chest. This is interesting because the tumors seem to be caused by disease instead of injury, which is different from most of the rest of the papyrus. Also, even though this case actually says the surgeon will contend with it, the treatment given is specifically to not treat the patient. However, this injury can be treated now by surgically removing the tumors.[69] The final ineffective treatment given is in one possible outcome of Case 47, where the patient has a gaping wound in their shoulder and develops a fever due to infection. This can be treated now in a number of ways, including fever reducing medications, and more methods are being developed every year, such as nanoparticles to eliminate pathogens causing the infection and aid in the healing process.[70]

After evaluating all the injuries that had ineffective treatments given in the ESP, it is clear that there are effective modern treatments for all of them. This is due primarily to increased imaging technology to make it easier to diagnose internal injuries, antibiotics to stave off infection, and clean surgical tools to operate on the patient. Thus, modern practices are effective for treating every injury listed in the ESP.

[67] Sudkamp et al. 2009, 1327.
[68] Feng et al. 2019, 1-2.
[69] David and Marshall 2011, 18.
[70] Negut, V. Grumezescu, and A. Grumezescu 2018, 2, 12.

CHAPTER III

COMPARISON AND ANALYSIS

Once the efficacy of ancient and modern treatments is established, they need to be compared to see if there is a statistically significant change between the percent of injuries that could be effectively treated then and now. This is done using a contingency table and the Fisher's Exact Test. A contingency table is used to find the difference between the two groups by calculating a p-value. The p-value is the probability that the two groups come from the same population, in this case meaning that there is no statistically significant difference in the number of treatments that were effective in ancient times and modern times. In order for there to be a statistically significant difference, the p-value would have to be less than or equal to 0.01. This particular test is used because it is better designed to deal with the small sample size in some of the squares in the contingency table, for example the size of 0 in the ineffective modern treatments since modern surgeons are able to treat all the injuries listed to some degree of efficacy.

Contingency Table

Table 4. *Contingency Table Comparing Ancient and Modern Treatment Efficacy*

		Time Period		
		Ancient	Modern	Total
Efficacy	Effective	35	56	91
	Ineffective	21	0	21
	Total	56	56	112

Note: The two-tailed p-value for this contingency table is $p = 9.42 \times 10^{-8}$.

Results

The result of the Fisher's Exact Test is that the p-value is < 0.000001, so there is a clear statistical difference between the two groups. This is expected given how much medicine has improved even just in the last century, but the test confirms this hypothesis.

Unchanged Treatments

While knowing if there is a significant difference in the number of injuries able to be treated is important, another aspect of this comparison includes looking at specific injuries to see if there are any that are unchanged between the two time periods. There are two cases in the Edwin Smith papyrus that are exactly what the prescribed treatment would be for the injuries today, which is interesting considering the vast time period between then and now. Specifically, Case 25 and Case 11 are still the best way to treat a dislocated jaw and a broken nose, respectively.[71] Another interesting note on Case 25 is that the manipulation of the jaw described there is also identical to the Hippocratic manipulation shown by Apollonius of Citium in *On Joints*, his commentary on Hippocrates' teachings.[72] The reason humanity has not found an improved treatment is most likely because these are simple and relatively common injuries for the whole of the human population. Therefore, every culture has determined how best to treat these injuries early on and continued those treatments throughout history.

[71] Forshaw 2015, 693; Meltzer and Sanchez 2012, 113.
[72] Breasted 1930, 303.

CONCLUSION

The first translator of the Edwin Smith papyrus (ESP), James Breasted, wrote in his translation that he did not have the ability to form a complete discussion of the medical knowledge displayed in the ESP, but that such an analysis should be formed.[73] This project attempts to contribute to that discussion by studying each case and determining whether it described an effective treatment.

There is a statistically significant difference between the percentage of injuries ancient Egyptians were able to treat effectively compared to modern surgical techniques. The ancient Egyptians could treat a much smaller percentage of cases that they encountered compared to modern surgeons. There were some surprises however, such as the treatments that are still used today, virtually unchanged, to fix a dislocated jaw or broken nose. Even if they were not as effective as doctors today, it must be acknowledged that the ancient Egyptians had a detailed and extensive body of knowledge for their surgeons to draw upon. This is impressive and the influence of Egypt on its neighbors, including the Greeks, can be seen in the historical record.

A future direction this research could go is examining mummified remains for injuries to the lower part of the body, past where the ESP ends, to see what other treatments were used and if any of them can be identified as having successfully treated an injury found on the body. Unfortunately, unless another medical papyrus of the same scientific caliber as the Edwin Smith is found, there is no way to know for sure exactly what treatments were used. Hopefully, one day another copy of this treatise might be found more intact to further the world's understanding of the oldest scientific medical writings.

[73] Breasted 1930, 45.

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APPENDIX A

EVALUATION OF TREATMENTS IN THE EDWIN SMITH PAPYRUS

Table 2. *Evaluation of Treatments in the Edwin Smith Papyrus*

Case Number	Brief Description of Injury[a]	Verdict[b] (1, 2, 3)	Description of Treatment	Efficacy (Effective or Ineffective)
1	A Wound in the Head, Penetrating to the Bone.	1	Bind it with fresh meat the first day and then treat with grease, honey, and lint until recovery. (96)	Effective
2	A Gaping Wound in the Head, Penetrating to the Bone.	1	Bind it with fresh meat the first day and apply two strips of linen. Then treat with grease, honey, and lint every day until recovery. (121)	Effective
3	A Gaping Wound in the Head, Penetrating to the Bone and Perforating the Skull.	1	Stitch up the wound, then apply fresh meat the first day. Do not bind it to the wound. Keep the patient on their usual diet and give no medicine until they start to get better. Then treat it with grease, honey, and lint every day until recovery. (132)	Effective
4	A Gaping Wound in the Head, Penetrating to the Bone and Splitting the Skull.	2	Do not bind the patient, and keep them on their usual diet without medicine until they start to get better. Make two supports of brick to help them stay sitting upright until they reach a decisive point. Apply grease to their head and soften their neck and shoulders with it too. (150)	Effective
5	A Gaping Wound in the Head with Compound Comminuted Fracture of the Skull.	3	Do not bind the patient, just keep them on their usual diet without any medicine until they get better. (161)	Ineffective

Table 2. Continued

Case Number	Brief Description of Injury[a]	Verdict[b] (1, 2, 3)	Description of Treatment	Efficacy (Effective or Ineffective)
6	A Gaping Wound in the Head with Compound Comminuted Fracture of the Skull and Rupture of the Meningeal Membranes.	3	Anoint the wound with grease, but don't bind it at first. Once you know the patient will live, then apply two strips to the wound. (171)	Ineffective
7	A Gaping Wound in the Head, Penetrating to the Bone and Perforating the Sutures.[c] I. Patient finds it painful to open mouth, has a faint heartbeat, is discharging blood from both nostrils and both ears, and has a stiff neck so they can't look to the side or down. II. Patient also has a fever, is sweating, and their face is red and contorted, with their mouth clenched shut. III. Patient is also pale and is showing signs of exhaustion.	I. 2 II. 3 III. N/A	I. Make the patient a hot application to help relax their jaw muscles so they can open their mouth. Then bind it with grease, honey, and lint until you know whether they will live or not. (180) II. None given. III. Make a wooden brace for the patient to put in their mouth to hold it open. The administer a draught of *wrh*-fruit.[d] Keep the patient sitting upright with brick supports on either side of them until you know whether they will live or not. (184)	I. Ineffective II. Ineffective III. Ineffective

Table 2. Continued

Case Number	Brief Description of Injury[a]	Verdict[b] (1, 2, 3)	Description of Treatment	Efficacy (Effective or Ineffective)
8	Compound Comminuted Fracture of the Skull Displaying no Visible External Injury. I. Patient has swelling over the fracture, but no visible external injury, and their eye is askew on the side of the injury along with shuffling their leg on that side. II. Patient's brain is not throbbing in the area of the fracture until the skull is opened and they discharge blood from both nostrils and both ears and have a stiff neck.	I. 3 II. 3	I. Have the patient sit until you know whether they will live or die. (207) II. None given.	I. Ineffective II. Ineffective
9	Compound Comminuted Fracture of the Skull Displaying no Visible External Injury.	N/A	Triturate an ostrich egg with grease and place in the mouth of the wound. Then triturate more ostrich eggs for poultices to dry up the wound. Apply these poultices with a covering over the wound, and uncover it after three days. Say a charm over the poultices when applying them. After uncovering the wound, cool it with a compress of figs, grease, and honey, cooked, cooled, and applied to it. (219-220)	Ineffective

Table 2. Continued

Case Number	Brief Description of Injury[a]	Verdict[b] (1, 2, 3)	Description of Treatment	Efficacy (Effective or Ineffective)
10	Gaping Wound at the Top of the Eyebrow, Penetrating to the Bone.	1	Stitch up the wound and bind fresh meat to it for the first day. If you find the stitching is loose, draw the wound together with two strips of plaster and treat it with grease and honey every day until recovery. (232)	Effective
11	A Broken Nose.	1	Clean the nose with two plugs of linen. Then place two other plugs of linen saturated with grease inside their nostrils. Keep the patient on their normal diet with any medicine until the swelling goes down. Also apply stiff rolls of linen to hold their nose straight and after the swelling is reduced, treat them with grease, honey, and lint every day until they recover. (237)	Effective
12	A Break in the Nasal Bone.	1	Set the nose back into place and clean out the patient's nostrils with two swabs of linen until all the coagulated blood is removed. Then place two plugs of linen saturated with grease into both nostrils and bind two stiff rolls of linen to the outside of their nose. Treat with grease, honey, and lint every day until recovery. (246)	Effective
13	Compound Comminuted Fracture in the Side of the Nose.	3	None given	Ineffective
14	Flesh Wound in One Side of the Nose Penetrating to the Nostril.	1	Stitch up the wound and then clean out the nostrils with two swabs of linen until all coagulated blood is removed. Bind it with fresh meat the first day, then when the stitching loosens, take off the fresh meat and bind it with grease, honey, and lint every day until recovery. (257,259)	Effective

Table 2. Continued

Case Number	Brief Description of Injury[a]	Verdict[b]	Treatment	Efficacy (Effective or Ineffective)
15	Perforation of the Bone in the Region of the Maxilla and Zygoma.	1	Bind it with *ymrw*[e] and then treat it with grease and honey every day until recovery. (264)	Effective
16	Split of the Bone in the Region of the Maxilla and Zygoma.	1	Bind it with fresh meat the first day. The patient should stay sitting until the swelling is reduced, then treat it with grease, honey, and lint every day until recovery. (266)	Effective
17	Compound Comminuted Fracture of the Bone in the Region of the Maxilla and Zygoma.	3[f]	Bind it with fresh meat the first day and have the patient sit until the swelling is reduced. Then treat it with grease, honey, and lint every day until recovery. (269)	Effective
18	Wound in the Soft Tissue of the Temple, the Bone Being Uninjured.	1	Bind it with fresh meat the first day, and treat it with grease, honey, and lint every day after that until recovery. (273)	Effective
19	Perforation in the Temple.	1	Treat the wound with grease, honey, and lint every day until the patient recovers, and keep them on their regular diet without any medicine. (281)	Effective
20	Wound in the Temple Perforating the Bone.	3	Have the patient stay sitting up, soften their head with grease, and pour milk into both ears. (286)	Ineffective
21	A Split in the Temporal Bone.	2	Keep the patient on their normal diet without medicine until you know whether they will live or not. (289)	Ineffective
22	Compound Comminuted Fracture of the Temporal Bone.	3	None given.	Ineffective
23	Slit in the Outer Ear.	1	Stitch the wound together on the back of the patient's ear. If the stitching becomes loose, then make stiff rolls of linen to pad the back of their ear with and treat it with grease, honey, and lint every day until recovery. (298, 300)	Effective

Table 2. Continued

Case Number	Brief Description of Injury[a]	Verdict[b]	Treatment	Efficacy (Effective or Ineffective)
24	Fracture of the Mandible.	3	None given.	Ineffective
25	Dislocation of the Mandible.	1	Put your thumbs on the ends of the two ends of the mandible in the inside of the patient's mouth and your two groups of fingers under their chin and cause them to fall back so the jaw rests in its place. Then bind it with *ymrw* and honey every day until recovery. (304-5)	Effective
26	Wound in the Upper Lip.	1	Stitch up the wound and bind it with fresh meat the first day. After that, treat it with grease and honey every day until recovery. (307-8)	Effective
27	Gaping Wound in the Chin.	1	Apply two strips on the gash. Bind it with fresh meat the first day and after that, treat it with grease, honey, and lint every day until recovery. (311)	Effective
28	Gaping Wound in the Throat Penetrating to the Gullet. I. The wound is inflamed and the patient has a fever from it. Also, if they drink water, they choke on it and it comes out the wound. II. The patient continues to have a fever after treatment.	I. 2 II. N/A	I. Stitch up the wound. Bind it with meat the first day and treat it with grease, honey, and lint every day after that until recovery. (315) II. Keep patient on their normal diet without medication and apply dry lint to the wound. (316)	I. Effective II. Ineffective
29	Gaping Wound in a Cervical Vertebra.	2	Bind it with fresh meat the first day and then keep the patient on their regular diet without any medicine until they start to recover. (319)	Effective
30	Sprain in Cervical Vertebrae.	1	Bind it with fresh meat the first day. Then treat with honey and *ymrw* every day until recovery. (321)	Effective

Table 2. Continued

Case Number	Brief Description of Injury[a]	Verdict[b]	Treatment	Efficacy (Effective or Ineffective)
31	Dislocation of a Cervical Vertebra.	3	None given.	Ineffective
32	Displacement of a Cervical Vertebra.	1	Bind it with fresh meat the first day. Loosen the patient's bandages and apply grease to their head as far back as their neck and bind it with *ymrw*. Treat it after that with honey every day and sitting until recovery. (336)	Effective
33	Crushed Cervical Vertebra.	3	None given.	Ineffective
34	Dislocation of the Two Clavicles. I. The patient's shoulders are turned over, and the heads of their two collarbones are turned towards their face. II. The two collarbones have a rupture of the tissue over them, penetrating to the interior.	I. 1 II. 1[g]	I. Cause the bones to fall back to rest in their places. Then bind it with stiff rolls of linen and treat it with grease and honey every day after that until recovery. (344) II. None given.	I. Effective II. Ineffective
35	Fracture of the two Clavicles.	1	Place the patient lying on their back with something folded between their shoulder-blades. Spread out their shoulders to stretch apart the collar-bone until the pieces fit back together. Then make two splints of linen and apply one of them on the inside of their upper arm and the other on the under side of their upper arm. Bind it with *ymrw* and treat it with honey every day after until recovery. (352)	Effective

Table 2. Continued

Case Number	Brief Description of Injury[a]	Verdict[b]	Treatment	Efficacy (Effective or Ineffective)
36	Fracture of the Humerus.	1	Place the patient on their back, with something folded between their shoulder blades. Spread out their shoulders to stretch out their upper arm until the broken pieces fall back into place. Then make two splints of linen and apply one to the inside of their upper arm and the other to the outside of their upper arm. Then bind it with *ymrw* and treat with honey every day until recovery. (356-7)	Effective
37	Fracture of the Humerus with Rupture of Overlying Soft Tissue. I. A wound has been smashed over the fracture area. II. An open wound is found going down to the fracture with blood coming from it.	I. 2 II. 3	I. Make two splints of linen[h] and bind it with *ymrw*. Then treat it with grease, honey, and lint every day until you known whether the patient will live or die. (359) II. None given.	I. Effective II. Ineffective
38	Split in the Humerus.	1	Bind it with *ymrw* and treat it with honey every day until recovery. (362)	Effective
39	Tumors or Ulcers in the Breast Perhaps Resulting from Injury.	1	Use a fire-drill to burn the patient's tumors. Then treat them with wound treatment[i]. Do not prevent the wound from opening, so that there may be no *mnhty'w*[j] in the wound. Every wound that is in their breast dries up as soon as it opens itself. (366)	Effective
40	Wound in the Breast.	1	Bind it with fresh meat the first day and treat it with grease, honey, and lint every day after that until recovery. (371)	Effective

Table 2. Continued

Case Number	Brief Description of Injury[a]	Verdict[b]	Treatment	Efficacy (Effective or Ineffective)
41	Infected or Possibly Necrotic Wound in the Breast.	1	Make application of willow leaves, *nbs*-tree, and *ksnty* and apply it. Then make application of *ym*-tree leaves, dung, *hny-t*, and *ksnty* and apply that. Then triturate an application of green pigment powder, *wsb-t*, *thn-t*, and grease and bind that on the wound. Then triturate application of northern salt and ibex grease and bind that on it. Finally, make a poultice out of red *spnn*, garden tongue, *drt*, and sycamore leaves and bind that on it. (379).	Effective
42	Sprain of the Sterno-Costal Articulations.	1	Bind it with *ymrw* and treat with honey every day until recovery. (393)	Effective
43	Dislocation of the Sterno-Costal Articulations.	1	Bind it with *ymrw* and treat with honey every day until recovery. (397)	Effective
44	Fractured Ribs.	3	None given.	Ineffective
45	Bulging Tumors on the Breast.	2	Do not treat the patient. (405)	Ineffective
46	Abscess with Prominent Head on the Breast.	1	Treat with cold applications made by triturating and binding *sh-t* fruit, *ntr-t*, and *ksnty*. Then triturate and bind fruit of *ss*, *ksnty*, mason's mortar, and water on it. If there is resistance to these applications, avoid any more remedies until all the fluid in the abscess is drained out. Then bind on it a wound treatment made from acacia and sycamore leaves, juice of *ym*-leaves, ox dung, and *hny-t*. Then make astringents from powder of a green pigment, *dr-t* of cedar, ointment fat, northern salt, and ibex grease and bind it on the abscess. Finally make poultices from red *spnn* and sycamore and triturate and apply it. (411)	Effective

Table 2. Continued

Case Number	Brief Description of Injury[a]	Verdict[b]	Treatment	Efficacy (Effective or Ineffective)
47	Gaping Wound in the Shoulder. I. The patient has a gaping wound in their shoulder and swelling in their shoulder blade. II. If the stitching comes loose and the wound opens again. III. If the stitching comes loose and the wound is open and inflamed with pus discharging from it. a. If the fever continues while the wound is inflamed. b. If the fever ends and the inflammation dissipates entirely.	I. 1 II. N/A III. 2 a. N/A b. N/A	I. Stitch the wound together and bind it with fresh meat the first day. (420) II. Pull the wound together with two strips of linen over the gash and treat it with grease, honey, and lint every day until recovery. (421) III. N/A a. Do not bind it, keep the patient on their normal diet without and medicine until they start to recover. (424) b. Treat it with grease, honey, and lint every day until recovery. (425)	I. Effective II. Effective III. N/A a. Ineffective b. Effective
48[k]	Sprain in a Spinal Vertebra (incomplete).	1	Have the patient lie down on their back. Then the papyrus ends so the remaining treatment is unknown.	N/A

Note: Lists for each case in the Edwin Smith papyrus: a brief description of the injury presented, the verdict given by the author, a summary of the treatment prescribed and page number to find it in Breasted 1930, and a determination of whether the aforementioned treatment would be effective at helping the patient or not.

[a] Description of injuries from Breasted 1930, 33-35. Lists indicate that the injury has multiple examinations that might develop, with possibly different verdicts depending on which symptoms present. Seen as I, II, III, etc.

[b] Verdict 1: "An ailment I will treat", Verdict 2: "An ailment I will contend with", Verdict 3: "An ailment not to be treated".

[c] Case 7 contains an injury that might develop along two separate lines. The first examination (I) indicates the base description of the patient and the outcomes if that is all that is seen. Then there is a second examination that could lead to either II or III for the verdict and treatment depending on how the patient is progressing.

[d] *Wrh*-fruit is an unknown fruit or grain that is seen in images of granaries. Breasted 1930, 184.
[e] *Ymrw* is a word that occurs seven times in the ESP, but is not found in any other writings. The determinative shows that it is a mineral, but it is unidentifiable past that. Breasted 1930, 264.
[f] Case 17 has verdict 3 given, but also follows it up with a treatment suggesting recovery, so it is likely that there is a scribal error in this case, either with the original verdict or with the treatment. The treatment is identical to the case before it, so it seems more likely that the scribe wrote "until he recovers" at the end of the treatment without thinking about it and verdict 3 is correct.
[g] Verdict 1 is written, but because of the lack of treatment given and the considerable parallels with the second examination in Case 37, Breasted believes that the second examination of Case 34 should contain verdict 3 instead of verdict 1. Breasted 1930, 346.
[h] Breasted argues that because the Case 37 treatment consists mostly of words suggesting familiar measures for the surgeon to take, and because of the order of commands in Case 36, the setting of the bone in Case 37 is implied because the surgeon is told to make the bandages. Breasted 1930, 359.
[i] Wound treatment here probably means an externally applied remedy for inflammation, because that is how it is used in Case 46 and the word for wound in Case 39 likely means sore based on context. Breasted 1930, 367.
[j] *Mnhty'w* is unknown outside of this instance, so its meaning cannot be determined. Breasted 1930, 367.
[k] Not included in final analysis due to being incomplete and not having a treatment listed, but indicating that a treatment was written prior to the papyrus ending.