

Learning outcomes

- Understand how the experience of war on the Western Front gave rise to new techniques in medical treatment.
- Understand how new methods of surgery developed to treat the large number of head injuries that were a result of trench warfare.

Surgery & Medicine

The significance of the Western Front for experimenting



New techniques in the treatment of wounds & infection



One of the main problems facing the RAMC was infections, mostly caused by gas gangrene.

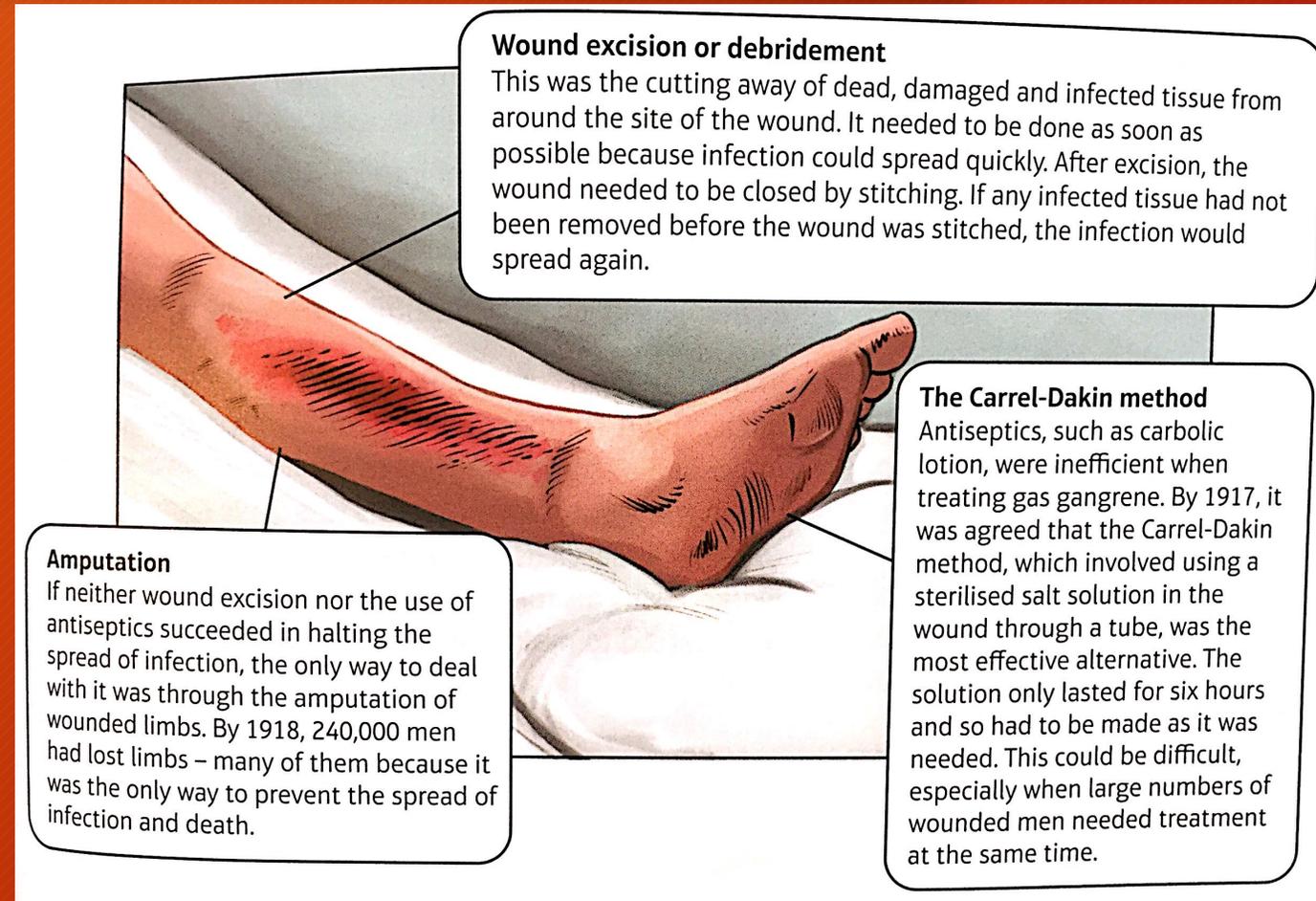
Do you think aseptic surgery was possible? Why?

- Contaminated conditions
- Sheer number of wounded men

Because of this, other methods of treatments were needed. This caused conflict between the medics on the front line and the doctors in Britain

Imagine a soldier has arrived at your ADS, briefly write down his options for treatment

The main techniques used to prevent infection from spreading



Source A

From the diary of B. C. Jones, 1915–16. Jones served with the Royal Field Artillery in France from the start of the war until he was wounded in 1915.

7 December. A German shell hit the dugout of our telephone pit. I remembered no more until I woke up in Bethune Casualty Clearing Station Number 33, where I find I have been severely wounded. Left hand blown off, left arm ripped up 12 inches. Scalp wound 6 inches, wound on over side of knee (left) 5 inches.

9 December. Operation on upper arm for gangrene (successful).

12 December. I remain here for 8 days then removed to St Omer by hospital barge, very comfortable. I am then removed by train to Étaples. I am sent to England on the Hospital Ship. Return to Nottingham where I am in bed until the end of February.

3 June 1916. I am eventually transferred to Brighton where I am operated on and re-amputated. Awaiting Roehampton for artificial limb.

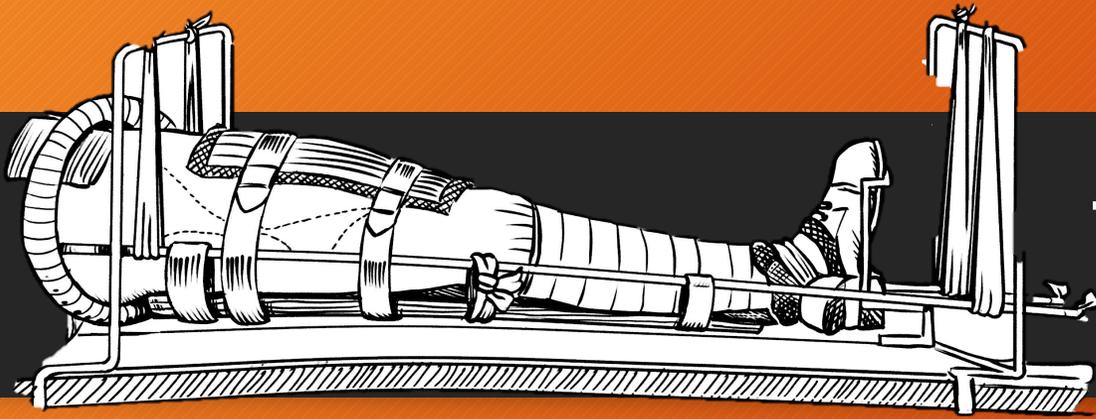
Source B

From Ward Muir's Observations of an Orderly, published in 1917. Muir was a Lance Corporal in the RAMC and worked in a hospital in London that received patients from the Western Front at the end of the chain of evacuation.

The majority of stretcher-cases... reach us in a by no means desperate state, for, as I say, they seldom come to England without having been treated previously at a base abroad (except during the periods of heavy fighting). And it is remarkable how often the patient refuses help in getting off the stretcher on to the bed. He may be a cocoon of bandages, but he will courageously heave himself overboard, from stretcher to bed, with a wallop which would be deemed rash even in a person in perfect health.

Study sources A & B:

- What conclusions can you draw from the fact the soldier in A needed to have a limb re-amputated when he returned home?
- Make a list of inquiries Sources A&B would be useful for



The Thomas Splint 1915



In 1914/15, men with a gunshot or shrapnel wound to the leg only had a 20% chance of survival

Why do you think this was?

- Compound fractures pierced the skin = infection and broken bone inside the leg
- If the femur (thigh bone) was fractured this would lead to massive muscle damage and bleeding into the thigh

Robert Jones, nephew of Hugh Thomas went to Boulogne in 1915 to instruct medics how to use his uncle's splint

Survival rates went from 20% to 82%

The splints they originally used didn't keep the leg rigid so by the time they arrived at the CCS he'd have lost a lot of blood, would be in shock and maybe already developing gas gangrene.

Those who survived had their leg amputated at the CCS.

The Thomas Splint was developed in the late 19th Century by Hugh Thomas and was designed to stop joints moving

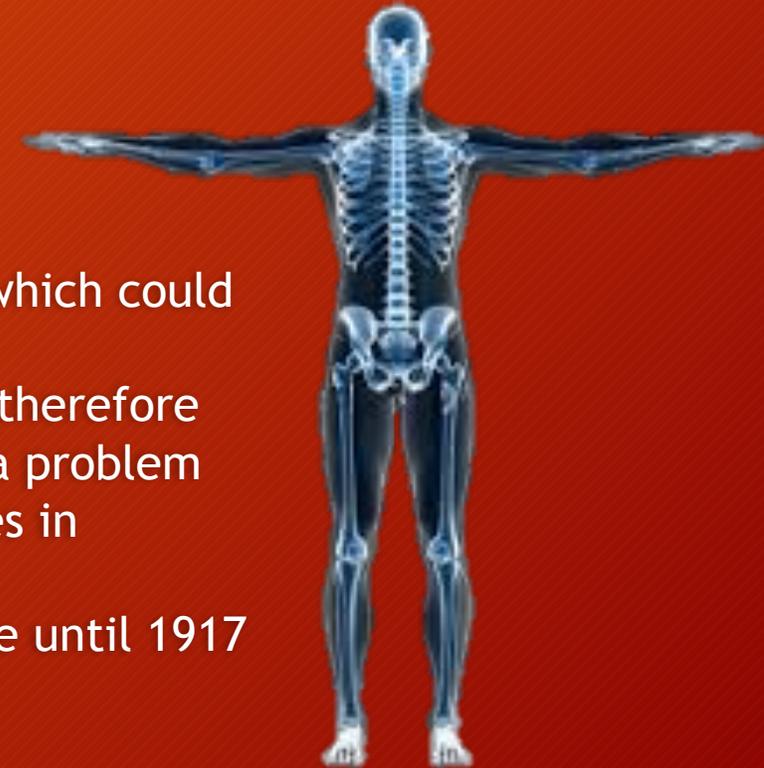
Mobile X-Rays



X-Rays were used from the start of the war, mainly to identify shell fragments and bullet wounds that if not removed from the body could cause infection. Two X-Rays were taken from different angles to help the surgeon locate the shrapnel and bullets.

Problems with X-Rays on the Western Front:

- X-Rays couldn't detect all objects in the body eg fragments of clothing
- The length of time a wounded man had to remain still was several minutes which could cause problems depending on the wound
- The tubes used in X-Ray machines were fragile and overheated very quickly therefore could only be used for about an hour at a time to then cool down. This was a problem due to the number of wounded soldiers - the solution was to have 3 machines in rotation
- The USA had developed better technology and bulbs but this wasn't available until 1917 when the USA entered the war



Mobile X-Rays



The Base Hospitals and some of the larger CCSs had static x-ray machines as part of their equipment. There were 6 mobile x-ray units operating in the British sector of the Western Front that could be called upon.

Setting up the mobile unit took some time.

- A tent was attached to the back of the van with a table where stretchers could be placed
- The x-ray machine was placed next to the table linked to the engine
- Equipment for processing the x-ray films was set up inside the van
- Quality wasn't as good as the static x-ray but was sufficient in identifying the shrapnel and bullets

Source D

A photograph of a mobile x-ray unit, taken in 1917. Notice how the equipment has been laid out.



Look at Source D and describe how this mobile x-ray worked

Exam Q2b: Following up a source

How could you follow up Source C to find out more about x-rays on the Western Front?

In your answer you must give the question you would ask and the type of source you could use

Detail in Source C that I would follow up...

Question I would ask...

What type of source I could use...

How this might help answer my question...

Exam tip

This question involves a four-stage process. The example shows you what to do at each stage.

- **Pick a detail.** For example, 'a great development in the provision of motor wagons.'
- **Question I would ask.** How many x-ray vehicles were used in 1917 on the Western Front?
- **Type of source I would use.** Military records showing the number of x-ray vehicles being used in 1917 on the Western Front.
- **How this might help answer my question.** The data would show whether the numbers increased and quantify the words 'great development' in the statement in Source C..

Source C

From *Radiography and Radiotherapeutics*, by Robert Knox, published in 1917. This was a textbook on the use of x-rays written by a British doctor.

The need for portable outfits in connection with the war has led to a great development in the provision of motor wagons containing complete x-ray apparatus with all accessories. The mechanism used for driving the wagon i.e. the motor is coupled with a powerful dynamo which delivers a continuous current.



Blood transfusions & storage:



The use of blood transfusions from 1915 in the British Sector of the Western Front was pioneered by a Canadian doctor, Lawrence Bruch Robertson in the Base Hospital at Boulogne.

Syringe & tube was used to transfer the donor blood to the patient before surgery and to prevent going into shock. Those who didn't reject the blood, generally survived so due to this success they started doing transfusions in the CCSs as a matter of routine.

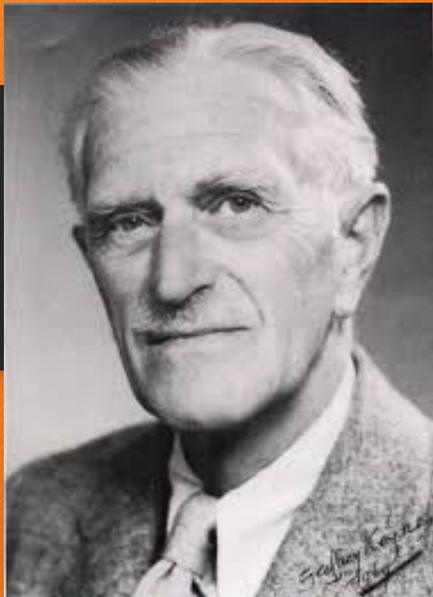
Geoffrey Keynes, a British doctor and lieutenant in the RAMC, designed a portable blood transfusion kit that was used closer to the front line

Remembering what you learnt about blood transfusions and storage, clotting and sterilising equipment a few weeks ago, design a perfect portable blood transfusion kit.



Main problem with Keynes's kit was the lack of refrigeration available so it did not use stored blood.

He did however add a device to his blood bottle to regulate the flow which helped prevent it from clotting.



Geoffrey Keynes



What can you learn about Geoffrey from his Medal card

“I spent 2 weeks studying with the Harvard [Blood Transfusion] unit and during that time I contributed something by devising an improved apparatus. I went back to the CCS where I was working and introduced the method there. It saved countless lives of men who would have otherwise died from shock and loss of blood. It provided an incomparable extension to the possibilities of life saving surgery. A preliminary transfusion enabled me to do a major amputation single-handed. A second transfusion then established the patient firmly on the road to recovery that he could be dismissed to the war without any further anxiety,

An interview with Geoffrey Keynes in 1980

Name:		Rank:	No.
KEYNES		LIEUT	
GEOFFREY LANGDON		Capt.	
Medal	Vol.	Page.	Remarks.
4 STAR	C.502	58	Langdon's medals mentioned name substituted by those for P. W. M.
BRITISH VICTORY	C.291		
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FRANCE 23.8.14.			
File No.		20/9/40 38/K/1425	

(1709) Wt.20312 5m (3) 9.35 6p.619 C&SLtd J. 2829

Study this source, compile a NOP and then make a list of strengths and weaknesses, what might affect its usefulness?

The blood bank at Cambrai, 1917



The identification of blood groups and the use of blood type O as a universal donor blood type meant that the risk of being transfused with the wrong blood was reduced. The problem of clotting remained and there was never enough blood to meet demand.

As the war went on, advances in storage of blood were made:

- 1915: American doctor Richard Lewisohn discovered that by adding SODIUM CITRATE to blood stopped it from clotting, the need for donor-to-donor transfusion was removed
- 1915: Richard Weil discovered that blood with sodium citrate could be refrigerated and stored for up to 2 days
- 1916: Francis Rous and James Turner found that by adding citrate glucose solution to blood, it could be stored for much longer - up to 4 weeks. When planning a big attack, they could now ask for donations in the weeks before to prepare for the demand!



The Battle of Cambrai 1917



The use of stored blood was clearly shown in 1917 at the Battle of Cambrai. Before the battle Oswald Hope Robertson stored 22 units of type O (universal) blood in glass bottles stored in ammunition boxes packed with ice and sawdust. He called this a blood depot.

During the battle he treated 20 severely wounded Canadian soldiers with the 22 units of blood, some of which was 26 days old. None of the wounded were expected to survive due to their injuries and going in to shock, of the 20, 11 survived!

This was the first time stored blood was used to treat shock, and although only small scale, it showed its potential. The outcome of this was that following Cambrai, only the most severely wounded were taken to the CCS

Design a comic strip / flowchart / news article to show this story to **SOMEONE** of your choice back home!
Who will it be for? What will the tone of your work be like? Positive? Negative? Just informative?

Head injuries & Brain surgery



About 20% of all wounds in the British sector of the Western Front were to the head, face and neck. **WHY?**

Injuries to the brain were very likely to prove fatal at the start of the war because:

- The issue of infection applied just as much to the head as other parts of the body
- There were difficulties involved in moving men with head injuries through the chain of evacuation as they were unconscious or confused
- There were very few doctors who had experience of neurosurgery (nervous system, brain & spinal)

Observation	New method of treatment
Men who were operated on quickly were more likely to survive.	Specific Casualty Clearing Stations became chosen as centres for brain surgery. For example, during the Third Battle of Ypres, all head injuries were moved to the Casualty Clearing Station at Mendinghem.
It was dangerous to move men too soon after an operation.	Patients remained at the Casualty Clearing Station for three weeks after surgery.
Injuries that looked fairly minor could be hiding more severe injuries.	All head wounds were always carefully examined.

Observations quickly led to improvements, Harvey Cushing developed new techniques in brain surgery on the Western Front using Magnets to remove metal fragments. He used local anaesthetics when operating as general anaesthetics made the brain swell. As he observed more, he learned more too. He operated on 45 patients in 1917 with a 71% survival rate

Source E

From *A Surgeon's Journal 1915–18*, by Harvey Cushing, published in 1936. Here he is describing the conditions under which he is working during the battle of Passchendaele on 19 August 1917.

My prize patient, Baker, with the shrapnel ball removed from his brain, after doing well for three days suddenly shot up a temperature to 104 last night about midnight. I took him to the operating theatre, reopened the perfectly healed external wound, and found to my dismay a massive gas infection of the brain. I bribed two orderlies to stay up with him in the operating room, where he could have constant thorough irrigation over the brain and through the track of the missile [passing a warm saline solution along the path taken by the shrapnel to prevent infection]. No light except candles was permitted last night.

N
O
P

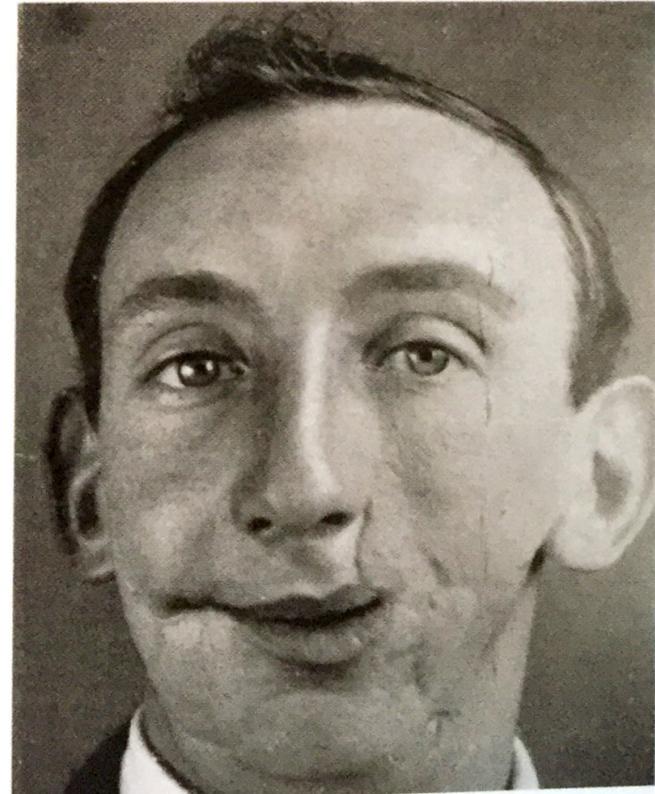
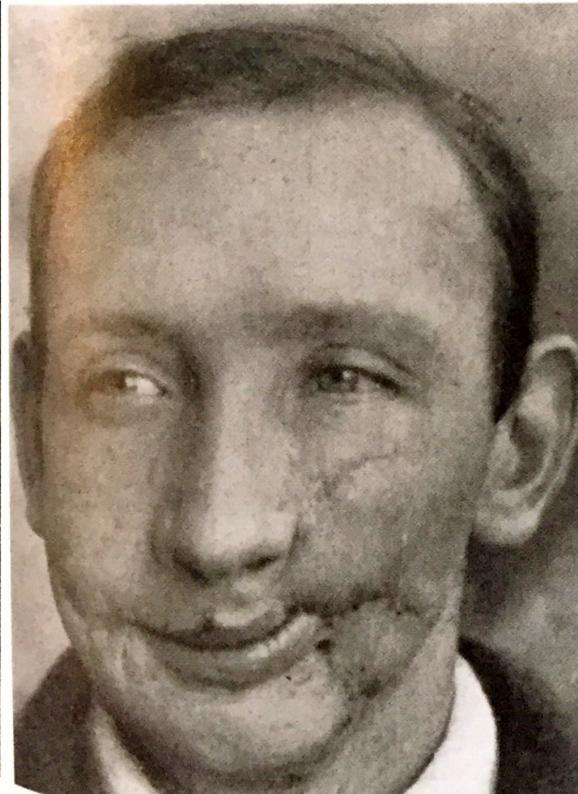
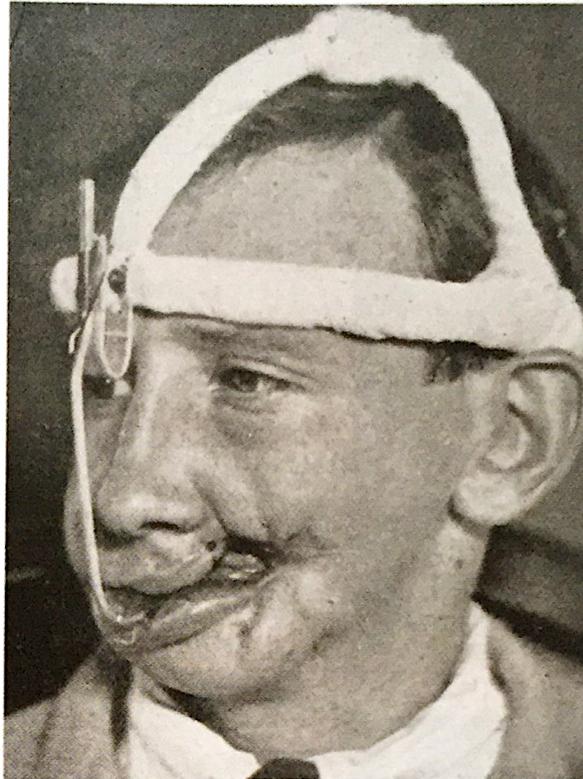
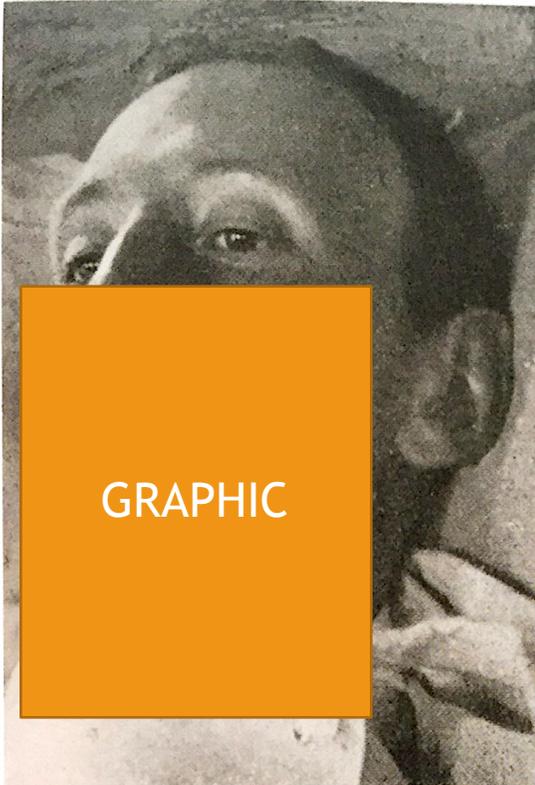
- 1 Why do you think Baker was Cushing's 'prize patient'?
- 2 What happened to make Baker's temperature rise?
- 3 What do you learn about the problems facing surgeons on the Western Front?



Plastic Surgery

Source F

Four photographs documenting the facial reconstruction of a soldier whose cheek was extensively wounded during the Battle of the Somme (July 1916).



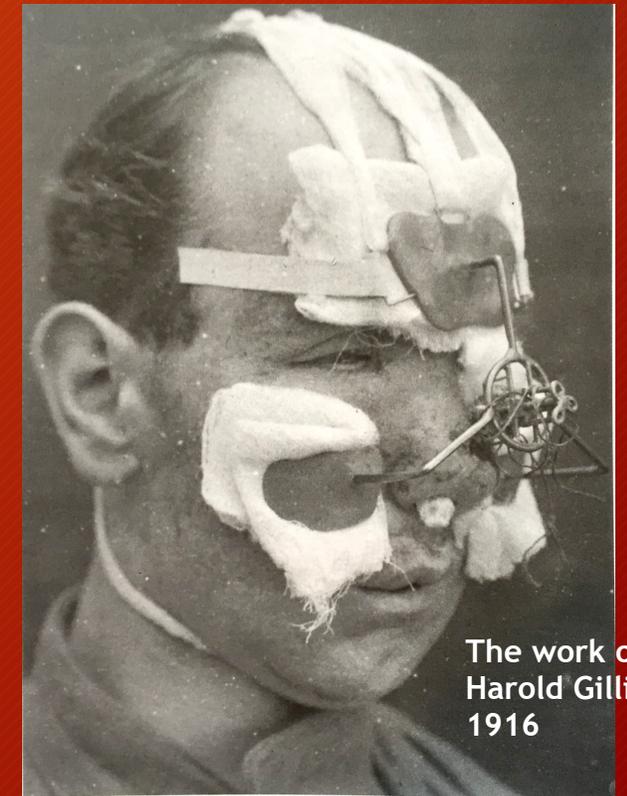
Plastic Surgery

WWI plastic Surgery video



The development of plastic surgery was largely the work of Doctor Harold Gillies. Before the war he was an ENT (ear, nose and throat) surgeon. He was sent to the Western Front in January 1915. Head injuries that didn't kill could cause severe disfigurement. This led Gillies to become interested in facial reconstruction. He had no experience in this work so devised new operations as he met each patient.

The intricate operations and recovery that were required in plastic surgery could not be carried out in France so it was done in Britain. Gillies helped design the Queen's hospital in Sidcup, Kent to meet his needs. By the end of the war, nearly 12,000 operations had been carried out!



Source H

From *A Surgeon's Journal 1915–18*, by Harvey Cushing, published in 1936. This work is made up of extracts from the journal kept by American surgeon Cushing during the war. Here he is describing his first impressions of medical treatment on the Western Front soon after his arrival in France on 2 April 1915.

It is difficult to say just what are one's most vivid impressions: the amazing patience of the most seriously wounded, some of them hanging on for months; the dreadful deformities (not so much in the way of amputations, but broken jaws and twisted, scarred faces); the tedious healing of infected wounds with discharging sinuses, tubes, irrigation and repeated dressings. Painful fractures are simply abandoned to wait for wounds to heal, which they don't seem to do.

The value of evidence

Read Source H, then work through these tasks.

- 1 Write down at least two ways in which Cushing's memoir is useful for explaining injuries on the Western Front.
- 2 Compare your answers with a partner, then try to come up with at least one limitation of the source.
- 3 With your partner, decide how useful this source is for explaining injuries on the Western Front on a scale of 1 to 10 (10 being very useful).
- 4 What if the source was used to answer the question: 'How is Cushing's memoir useful for explaining the work done by surgeons and doctors on the Western Front?'
 - a Write down any ways in which the source is useful for answering this new question.
 - b Write down any limitations for answering the new question.
 - c With your partner, decide how useful this source is for answering the question on a scale of 1 to 10.
 - d Can you think of another enquiry for which this would be a useful source? Write it down and score the source on a scale of 1 to 10.
- 5 Compare your scores out of 10. How does the question being asked affect how useful a source is? Explain your answer.
- 6 Can you think of any other factors that might affect the usefulness of the source?



Summary

Activities

- 1 Make a list of the improvements in medical techniques that occurred on the Western Front.
- 2 Divide this list into those improvements that were linked to medical practice and those that involved other factors.
- 3 What are the other factors that contributed to medical improvements?



Summary

- Many new medical techniques and ideas were pioneered to meet the needs of those wounded on the Western Front.
- The Thomas splint was responsible for a dramatic decline in the number of deaths of men who received leg wounds.
- Mobile x-ray units enabled surgeons to see where shrapnel and bullets remained in the body. This reduced the number of deaths from infection by gas gangrene.
- The first use of stored blood in blood transfusions was at the Battle of Cambrai.
- Harvey Cushing developed new methods of brain surgery.
- Harold Gillies developed the effective use of plastic surgery for men who had suffered severe facial injuries.

Checkpoint

Strengthen

- S1** List the different medical techniques used to treat the wounded on the Western Front.
- S2** Explain the significance of the Blood Bank at Cambrai.
- S3** What can you learn about plastic surgery from Sources G and H?

Challenge

- C1** Look at the ways in which medical techniques improved. Which of these improvements do you think was the most important on the Western Front? Explain your answer to a partner. Do you agree with each other?
- C2** How useful are Sources A and B as a study on treatment on the Western Front?

If you are not confident about any of these questions, form a group with other students, discuss the answers and then record your conclusions. Your teacher can give you some hints.

Source H

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Source G

