ISN

SPACE CAMP TÜRKİYE

An ESBAŞ Enterprise.

FIRST AID IN SPACE

ACTIVITY TAG

Purpose	At the end of this activity, the students understand human bone structure and its functionality in space or on Earth, students can apply their knowledge and understand the differences in bone structure in space compared to Earth with a basic orthopedic knowledge.
Short Description of the Activity	In this activity, students are divided into small groups and tasked with finding a solution to fix a broken bone in a microgravity environment. Students improve their problem-solving skills by using the materials provided to fix the broken bone, and also gain knowledge about the structure of the bones.
Materials	• Mission Explanation (Page 5) • 1 Meter Stick • Duct tape • Masking Tape • 15 Pencils (Unsharpened) • 2 A4 Size Paper) • 3 Pillow Case • 3 Balloon • 2 Plastic Bottles (1,5 Liter)
Location	Your classroom!
Duration	• Information (15 Minutes) • Application (20 Minutes) • Presentation (10 Minutes) • First Aid Application (15 Minutes)
Educational Objectives	• To show students basic bone structure and its functionality in space and on Earth. • To explain the applications to be made about how to treat a broken bone both in space and on Earth. • To show the differences that may occur in the bone structure in space or on Earth by giving a basic orthopedic knowledge.
School Subjects and Topics Concerned	**Science (Health):** To understand the skeletal systems of humans and other living things and how they behave in different conditions. **Science (Physics):** To understand the concepts of gravity and microgravity. **Engineering :** To comprehend how a structure or an object can be fixed in a way that does not move.
Scientific Standards	• Structure and Features of the Skeletal System • Physical and Chemical Changes • Force and Motion
Science Process Skills	• Problem solving • Understanding the Cause and Effect Relationship • Ability to Explain

In this activity, students focus on a "what if" scenario. During this scenario, a fellow astronaut (one in their group) has broken an arm in space. Other students, who are astronauts according to the scenario, will also try to find a way to fix the broken bone, using their materials and problem-solving skills until they return to home base.

Welcome to the First Aid in Space Activity. While trying to find a solution to a situation that has never been encountered in space, we will also discuss how we are able to stand on our feet and walk on Earth! So let's start!

It is normal for some differences to occur in the human body from the moment we leave our orbit for space exploration. For this reason, astronauts go through an intense preparation process, including a series of health and physical fitness checks, before going into space. Although many problems that may be encountered during space travel are foreseen by scientists and engineers, it is necessary to ensure that astronauts return to Earth safely in case of emergency. Therefore, astronauts must somehow solve a problem that may happen to them by using the materials they have with them. Before we start the activity, I want to ask you a question. What is the function of bone? Which is the strongest element of the skeletal system? What does bone do in the body of humans or other living things?

To measure participants' readiness: ask participants, what is bone? What does bone do in the body of humans or other living things? This should take approx 5 minutes.

In addition to the answers given, it should be explained to the students that the skeletal system supports the body, protects some organs in the body, produces red and white blood cells and stores minerals, gives shape to our body, determines height and body shape, and enables living things to move by working with muscles. Afterwards, the following information is given to the students.

In the space environment bones that cannot be used in resistance to gravity begin to deteriorate. The limited range of motion and lack of proper pressure in the first spacecrafts caused continued weakening of bones and muscles.

One of the most well-known consequences of living in space is the weakening of bones. Because moving in space doesn't require much effort, your muscles quickly lose strength and endurance.
An adult human body has calcium at the rate of about 1%-2% of the body mass and phosphorus at the rate of about 1%. 99% of calcium and 85% of phosphorus are found in bones. Throughout our lives, our bones are broken down by large cells called osteoclasts and calcium is released into the bloodstream. At the same time, other cells called osteoblasts produce new bone tissue.

For most of our lives, these two processes tend to balance each other out. However, that changes when an astronaut goes into space and lives in microgravity. Because in space, the body does not have to support its own weight with bones and is not subjected to pressure like on Earth. As a result, the calcium in astronauts bones is broken down and released into the bloodstream, causing a decrease in bone density. During a month in space, an astronaut's bone density may decrease by about 1%, which could increase the risk of bone fractures when returning to Earth. This loss could possibly be dangerous for a returning astronaut. In addition, calcium mixed with the blood can cause a disease in the kidneys called kidney stones.

In a study conducted by NASA in 2007 to "provide healthy bone structure of astronauts", it was discovered that the femoral bones of a group of astronauts staying on the space station decreased by 11% in mass during their mission. Only one year after returning to earth, astronauts regain the amount of bone they lost in space. Again, in the same study, it was revealed that the amount of bone lost by an astronaut staying in orbit for 1 month is equal to the amount of bone lost by an elderly woman during her lifetime.

Doctors examining millions of patients suffering from osteoporosis, also known as "bone resorption". They observed that bone density decreases day by day during the disease process, and as a result of this decrease, the porous bone can easily break. Even if they stay in the station for a long time, astronauts who exercise regularly in space do not encounter such a situation thanks to the exercise they do. In this activity you are a group of astronauts on a space station orbiting the Earth. In a moment, we will assign you to solve a problem that has never been encountered before at the station. Are you ready?

After the explanation, divide the students into 3 groups and distribute the mission explanation worksheet. Ask if the groups have any questions about their duties. Remind them that they have 20 minutes to practice. Indicate that they will then explain the solutions they find to the other groups.

If necessary, remind students that a broken arm can be tied in different ways, but the key is to keep the arm solid and immobile. Also, have students consider that they are in a space environment and whether fixing a bone in space might be easy or difficult.

After the time is up, have one student from each group describe the group's design. As the design is explained, encourage students to explain why they believe this is the best solution to fix a broken bone and how they decided on this solution.

Thank you for your ingenious ideas and great work on a never-before-seen situation in space. Let's hope such a situation never happens!

Astronaut Mission Briefing

URGENT

You and your teammates are in a space station orbiting the Earth. Due to an unexpected accident, one of your teammates now has a broken arm. This is unprecedented for your team! You must design a way to set and fix the broken bone in the microgravity atmosphere.

Here are a few things to consider as you work to find a solution.

- You have limited resources. You can use only the resources provided by us for this activity.
- There is no right or wrong answer for this exercise.
- As this has never happened before, no one is prepared for this!

The only other requirements for the project are the following:

1. The broken arm must be secure (it cannot move at all)
2. The broken arm has to be in a place where it cannot be further injured
3. The broken arm will continue to be in a microgravity environment for several days. Take this into consideration when finding your solution.

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