1
00:00:01,196 --> 00:00:04,166
[Brandi Dean] Good morning and welcome to the International
Space Station Flight Control Room,

2
00:00:04,166 --> 00:00:07,256
whereas I promised we're
talking with Dr. Jean Sibonga

3
00:00:07,566 --> 00:00:10,326
who is the Bone Lead for
the Human Research Program.

4
00:00:10,326 --> 00:00:11,496
So that's an interesting title.

5
00:00:11,496 --> 00:00:12,586
Bone Lead.

6
00:00:12,886 --> 00:00:15,946
[Dr. Jean Sibonga] Yeah. Essentially what that means
is I am the point of contact

7
00:00:15,946 --> 00:00:18,076
for every question that comes up in bone.

8
00:00:18,226 --> 00:00:20,106
Whether it comes from Engineering
or whether it comes

9
00:00:20,106 --> 00:00:22,326
from fellow scientists or
from Medical Operations.

10
00:00:22,636 --> 00:00:27,416
[Brandi] Well I know we are...bones are one of the
things we're really looking at a pretty hard

11
00:00:27,416 --> 00:00:30,866
since that spaceflight's been shown

to affect bones for the astronauts.

12
00:00:30,866 --> 00:00:31,896
Right? [Dr. Sibonga] Yes.

13
00:00:31,896 --> 00:00:38,926
In fact, probably...we've been studying it for
as long as we've been having human spaceflight.

14
00:00:39,396 --> 00:00:41,606
[Brandi] And...So what have we been seeing?

15
00:00:42,006 --> 00:00:48,056
[Dr. Sibonga] Well over the past 10, 15 years we've
been applying a clinical diagnostic test

16
00:00:48,056 --> 00:00:51,346
for evaluating osteoporosis in our astronauts.

17
00:00:51,346 --> 00:00:55,776
And some of that data has revealed
that we have some very unique changes

18
00:00:55,776 --> 00:00:57,686
in our astronauts up in space.

19
00:00:58,476 --> 00:01:02,616
[Brandi] Such as? [Dr. Sibonga] Well they have a very
accelerated rate of bone loss.

20
00:01:02,616 --> 00:01:07,346
And the bone loss is not
general across the skeleton.

21
00:01:07,346 --> 00:01:09,066
It's actually a specific site.

22
00:01:09,116 --> 00:01:11,316
It's the weight-bearing sites

that we have here on earth.

23
00:01:11,376 --> 00:01:13,976
You know so the lower half of
our body versus the upper body.

24
00:01:13,976 --> 00:01:14,856
It's our hips.

25
00:01:14,856 --> 00:01:16,256
It's our spine.

26
00:01:16,536 --> 00:01:18,676
[Brandi] Things that they don't use so
much when they're not in gravity.

27
00:01:18,996 --> 00:01:20,736
[Dr. Sibonga] No actually, it's the opposite.

28
00:01:20,916 --> 00:01:26,506
They use it a lot in gravity so that when they
go up into space there's this big differential.

29
00:01:26,506 --> 00:01:30,876
There's this deficit of having to...for
the bones to be strong and so they seem

30
00:01:30,876 --> 00:01:32,526
to adapt more and lose more mass.

31
00:01:33,456 --> 00:01:37,516
[Brandi] Okay. Well I know we see commercials about
"drink more milk" and things like that.

32
00:01:37,516 --> 00:01:42,446
But why is bone density important to begin with?

33
00:01:42,446 --> 00:01:48,056
[Dr. Sibonga] If you were to see some of the data that kind

of outlines bone loss and bone gain as humans,

34
00:01:48,056 --> 00:01:53,806
you know, grow up and certainly age over time,
you'll see that we have our peak bone mass

35
00:01:53,806 --> 00:01:58,096
around the age of 30 and 35 and then
after that it's kind downhill all the way.

36
00:01:58,096 --> 00:02:03,926
You know, it's a very slow process and
so when we think about osteoporosis,

37
00:02:03,926 --> 00:02:07,336
when we look at the elderly
people with their dowagers humps

38
00:02:07,336 --> 00:02:11,136
or with these fractures from very little trauma.

39
00:02:11,576 --> 00:02:16,296
This is because of the condition of
bone that has deteriorated over time.

40
00:02:16,296 --> 00:02:22,976
And so now it's not exactly a geriatric
disease, but it's actually geriatric consequence

41
00:02:22,976 --> 00:02:28,096
or a manifestation because of all of the risk
factors that people are exposed to through life.

42
00:02:28,096 --> 00:02:33,356
And so we want to understand if the
exposure of astronauts to prolonged periods

43
00:02:33,356 --> 00:02:36,296
up in space somehow contributes
to osteoporosis as well.

44
00:02:37,036 --> 00:02:38,746
[Brandi] And what are you findings so far?

45
00:02:39,246 --> 00:02:45,496
[Dr. Sibonga] Well we're finding with this very rapid loss,
that this has a concern because it seems to be

46
00:02:46,446 --> 00:02:52,016
of the magnitude or the range of
loss that seem s to kind of mimic

47
00:02:52,016 --> 00:02:54,346
or model what we see in postmenopausal women.

48
00:02:54,346 --> 00:02:59,186
Which is actually a big concern
for the clinical field here.

49
00:03:00,036 --> 00:03:03,986
However, we also have a lot of research data

50
00:03:04,146 --> 00:03:07,386
that reveals some interesting
things about these changes in space.

51
00:03:07,386 --> 00:03:13,476
One is that there are actually changes
in bone structure and that helps us

52
00:03:13,476 --> 00:03:20,556
to understand exactly how does exercise or
how do any of these are pharmacological agents

53
00:03:20,556 --> 00:03:22,046
that were using as countermeasures.

54
00:03:22,046 --> 00:03:26,796
Now how does this really impact the structure

of bone as well as the bone mineral density?

55
00:03:27,216 --> 00:03:31,226
[Brandi] Well, speaking of countermeasures, I know
that's one of the big things we're looking at,

56
00:03:31,226 --> 00:03:34,106
is how we actually combat
that bone density loss.

57
00:03:34,146 --> 00:03:36,826
So what are some of the things were doing now?

58
00:03:37,016 --> 00:03:41,556
[Dr. Sibonga] Well, for one thing being up in space,
there are a lot of our constraints.

59
00:03:42,386 --> 00:03:44,376
We can't always give the best diet.

60
00:03:44,606 --> 00:03:47,276
And we do as best as we can.

61
00:03:47,276 --> 00:03:51,526
There are some issues with
not having a lot of shielding.

62
00:03:51,526 --> 00:03:56,326
So we don't have the ultraviolet light that
helps us convert vitamin D for example.

63
00:03:56,516 --> 00:03:56,916
[Brandi] I'm sorry.

64
00:03:56,966 --> 00:03:57,396
Say that again.

65
00:03:57,396 --> 00:03:58,096
Ultraviolet light.

66
00:03:58,096 --> 00:03:58,606
What? [Dr. Sibonga] Ultraviolet.

67
00:03:58,606 --> 00:03:59,336
Well it's the sunshine.

68
00:03:59,336 --> 00:04:05,006
When we go out into sunshine it helps
to convert or metabolize vitamin D

69
00:04:05,006 --> 00:04:07,166
in our bodies and helps us to absorb calcium.

70
00:04:07,166 --> 00:04:10,336
You know, we have all that shielding
up in space on the space station.

71
00:04:10,336 --> 00:04:11,786
So that has an impact as well.

72
00:04:12,136 --> 00:04:14,556
And then just to be able to do exercise.

73
00:04:14,556 --> 00:04:19,556
You know, we are here and in a one
gravity environment here on earth

74
00:04:19,556 --> 00:04:21,866
and 24/7 were exposed to that gravity.

75
00:04:21,896 --> 00:04:25,986
But up there, you know, the only kind of loading
that they experience on the bone is maybe

76
00:04:25,986 --> 00:04:31,526
that those two hours, or less than two
hours, that we have from doing exercises.

77
00:04:31,896 --> 00:04:33,706
[Brandi] So what does exercise do that helps?

78
00:04:34,766 --> 00:04:40,846
[Dr. Sibonga] Well, you know, we...when it keeps up the,
you know...prevents kind of the muscles

79
00:04:40,846 --> 00:04:42,746
from atrophy up in space, you know.

80
00:04:42,746 --> 00:04:45,136
We like to maintain those
muscle forces on are bone.

81
00:04:45,256 --> 00:04:53,996
So essentially...excuse me...if our bones
don't have to work as hard as they do here

82
00:04:53,996 --> 00:04:59,326
on the Earth, because it's so easy to
move in weightlessness or...you know,

83
00:04:59,326 --> 00:05:01,456
they don't have that gravitational
force upon us.

84
00:05:01,556 --> 00:05:03,176
Then, you know, bone's pretty smart.

85
00:05:03,176 --> 00:05:07,196
Well, you know, I don't need to be
as strong as I usually am on Earth.

86
00:05:07,196 --> 00:05:10,166
And so it's going to be very efficient,
start to drop some of its mass.

87
00:05:10,406 --> 00:05:13,396
And that's what we're seeing with

the breakdown of bone up in space.

88
00:05:13,526 --> 00:05:14,796
[Brandi] Okay. So, efficiency.

89
00:05:14,796 --> 00:05:16,296
That's an interesting to put it.

90
00:05:16,296 --> 00:05:17,456
I hadn't thought of it like that.

91
00:05:17,546 --> 00:05:22,946
Especially when we don't use our muscles I guess
in space and on Earth we'd start to lose them

92
00:05:22,946 --> 00:05:24,176
and same thing happens with bones.

93
00:05:24,346 --> 00:05:25,396
[Dr. Sibonga] That's it exactly.

94
00:05:25,476 --> 00:05:27,536
It's a form of bone atrophy.

95
00:05:27,856 --> 00:05:32,066
[Brandi] Okay. And so one of the ways we
work on our bones was the exercise.

96
00:05:32,066 --> 00:05:34,466
But I know there are other things y'all
are doing for the countermeasures.

97
00:05:34,836 --> 00:05:35,366
[Dr. Sibonga] That's right.

98
00:05:35,366 --> 00:05:37,586
I mean...we want to exercise.

99

00:05:37,586 --> 00:05:40,736
Kind of keep our...kind of give a
reason for our bones to be strong.

100
00:05:40,736 --> 00:05:42,826
But in addition, you know,
that might not be enough.

101
00:05:42,886 --> 00:05:46,986
Because, as I said, exercise is only about
two hours a day or so, or even less than that.

102
00:05:47,026 --> 00:05:52,906
And then we also want to be able to, you know,
be able to provide supplementation of vitamin D

103
00:05:52,976 --> 00:05:57,256
because of the issues of not having
the sunlight as we do here on earth.

104
00:05:57,656 --> 00:06:02,276
And then there also kind of therapeutic
drugs that we use here on earth

105
00:06:02,326 --> 00:06:07,026
to combat metabolic bone diseases
that are very similar to the breakdown

106
00:06:07,026 --> 00:06:10,216
that we see up in space in our astronauts.

107
00:06:10,216 --> 00:06:13,536
So the agents that we use to prevent bone loss

108
00:06:13,606 --> 00:06:17,506
in post-menopausal women are
being tested up there in space.

109
00:06:17,716 --> 00:06:22,996
[Brandi] Okay. So vitamin D, is that something,

for instance, or the other medicines,

110
00:06:23,366 --> 00:06:27,146
do all of the astronauts use them all
the time or do some of them use it?

111
00:06:27,146 --> 00:06:28,466
Or how does that work?

112
00:06:28,786 --> 00:06:34,186
[Dr. Sibonga] Well, essentially it's a requirement so
we are providing supplementation to them

113
00:06:34,436 --> 00:06:39,076
and we do monitor those...that supplementation
to make sure that they have, you know,

114
00:06:39,316 --> 00:06:42,926
the requirements to be able
to maintain that level.

115
00:06:43,166 --> 00:06:46,596
[Brandi] Okay. And what are some of the
results we are seeing so far?

116
00:06:47,106 --> 00:06:50,246
[Dr. Sibonga] Well, you know, we don't
have directly those results.

117
00:06:50,246 --> 00:06:51,776
I mean...this is requirements.

118
00:06:51,776 --> 00:06:53,926
So we do kind of want to
monitor that all the time.

119
00:06:54,226 --> 00:06:57,786
As far as the effects on the
bone marrow density as a result

120
00:06:57,786 --> 00:06:59,916
of the phosphonates they're very encouraging.

121
00:07:00,356 --> 00:07:04,666
Also the effects of our new exercise
device that's up there is very encouraging.

122
00:07:05,116 --> 00:07:13,366
In fact, recently we had a bone summit
of a clinical panel, advisory panel,

123
00:07:13,366 --> 00:07:15,406
of some of the leaders in the bone field.

124
00:07:15,696 --> 00:07:19,776
And they had a chance to review
our medical and our research data.

125
00:07:19,776 --> 00:07:22,746
And they also came out with that
finding that it's encouraging data,

126
00:07:23,146 --> 00:07:24,906
but the jury's still out on this still.

127
00:07:25,246 --> 00:07:27,056
[Brandi] Okay. Well that's good news.

128
00:07:27,386 --> 00:07:29,806
And what about, you know, when
the astronauts get back to Earth

129
00:07:29,806 --> 00:07:33,016
and they start using their
bones like normal again?

130
00:07:33,016 --> 00:07:36,526
Does it start to correct itself or is it
that something you have to keep doing.

131
00:07:36,526 --> 00:07:41,556
I don't know, on special exercises, or
taking more vitamin D and other medicines.

132
00:07:41,896 --> 00:07:45,076
[Dr. Sibonga] Well, you know, that's a very
interesting thing that you bring

133
00:07:45,076 --> 00:07:47,526
up because this is something
that's dear to my heart.

134
00:07:47,526 --> 00:07:50,576
Essentially, we know that there
are changes in bone structure.

135
00:07:51,106 --> 00:07:53,436
We know that there are changes
in bone mineral density.

136
00:07:53,466 --> 00:07:58,196
But now the technology that we use now,
which is the clinically accepted technology,

137
00:07:58,496 --> 00:08:04,696
for diagnosing osteoporosis and little old
people or in post-menopausal women...uh,

138
00:08:04,696 --> 00:08:08,586
is not quite, and I have some limitations
when we apply it to our astronauts

139
00:08:08,586 --> 00:08:12,196
because our astronauts are, you know,
they're healthy and their robust

140
00:08:12,196 --> 00:08:14,536
and they through a very novel change.

141
00:08:14,536 --> 00:08:18,346
You know, not everybody here on Earth
is exposed to a weightless environment.

142
00:08:18,696 --> 00:08:23,906
And so there's actually a requirement
to look at...to collect more data

143
00:08:24,116 --> 00:08:26,876
as to how those changes...what
those changes are in bone.

144
00:08:26,876 --> 00:08:33,096
And so we have a flight study that's coming up
to actually to do a monitoring, or surveillance,

145
00:08:33,096 --> 00:08:35,836
of these changes in bone structure.

146
00:08:36,156 --> 00:08:40,856
And from those data, which come off of the
Quantitative Computed Tomography, which is an,

147
00:08:40,856 --> 00:08:44,496
you know, is an x-ray based imaging device.

148
00:08:45,316 --> 00:08:49,786
So when we take the data and we analyze
it with this computational tool,

149
00:08:49,886 --> 00:08:54,046
called Finite Element Modeling helps,
it helps us to estimate the strength

150
00:08:54,146 --> 00:08:56,016
of the bones particularly the hip.

151
00:08:56,516 --> 00:09:01,166
And with that knowledge we know where the lows

that are going to cause that bone to fracture.

152
00:09:01,396 --> 00:09:05,926
We could use that to kind of direct
their rehabilitation program.

153
00:09:06,006 --> 00:09:10,156
You know, how successful is
their countermeasure up in space,

154
00:09:10,256 --> 00:09:14,346
or how successful is the rehab
program after return to Earth,

155
00:09:14,346 --> 00:09:18,286
so that we could possibly avoid the
risk for a post-mission fracture.

156
00:09:18,566 --> 00:09:19,306
[Brandi] Interesting.

157
00:09:19,306 --> 00:09:22,416
Wow. Well so what about the...kind
of the other side of it?

158
00:09:22,416 --> 00:09:25,716
Are things that we're doing in finding
out about bones with the astronauts,

159
00:09:25,716 --> 00:09:28,066
is that helpful to people who are here on Earth?

160
00:09:29,036 --> 00:09:31,696
[Dr. Sibonga] Yes. You know, there is a population

161
00:09:31,696 --> 00:09:36,036
of folks that...who are immobilized
and are at risk for fractures.

162

00:09:36,036 --> 00:09:39,786
You know, like the spinal
cord injury population is.

163
00:09:39,836 --> 00:09:45,076
We're always looking for new ways of
evaluating bone as a predictor for fractures.

164
00:09:45,396 --> 00:09:49,536
And so doing the technologies that we're
applying the modeling technologies, you know,

165
00:09:49,536 --> 00:09:51,306
state-of-the-art, kind of, analyses.

166
00:09:51,306 --> 00:09:55,476
You know, if we could apply and get those
developed and validated and apply it

167
00:09:55,476 --> 00:10:00,516
to our patient population, you know, this is
going to be a great boon to the clinical field.

168
00:10:01,156 --> 00:10:01,726
[Brandi] Excellent!

169
00:10:01,726 --> 00:10:02,676
That's always good news.

170
00:10:03,236 --> 00:10:04,916
Thank you so much for coming
and talking with us.

171
00:10:04,916 --> 00:10:05,616
We really appreciate.

172
00:10:05,616 --> 00:10:06,926
[Dr. Sibonga] It was my pleasure.

173

00:10:07,376 --> 00:10:09,436
[Brandi] This again was Dr. Jean Sibonga who is