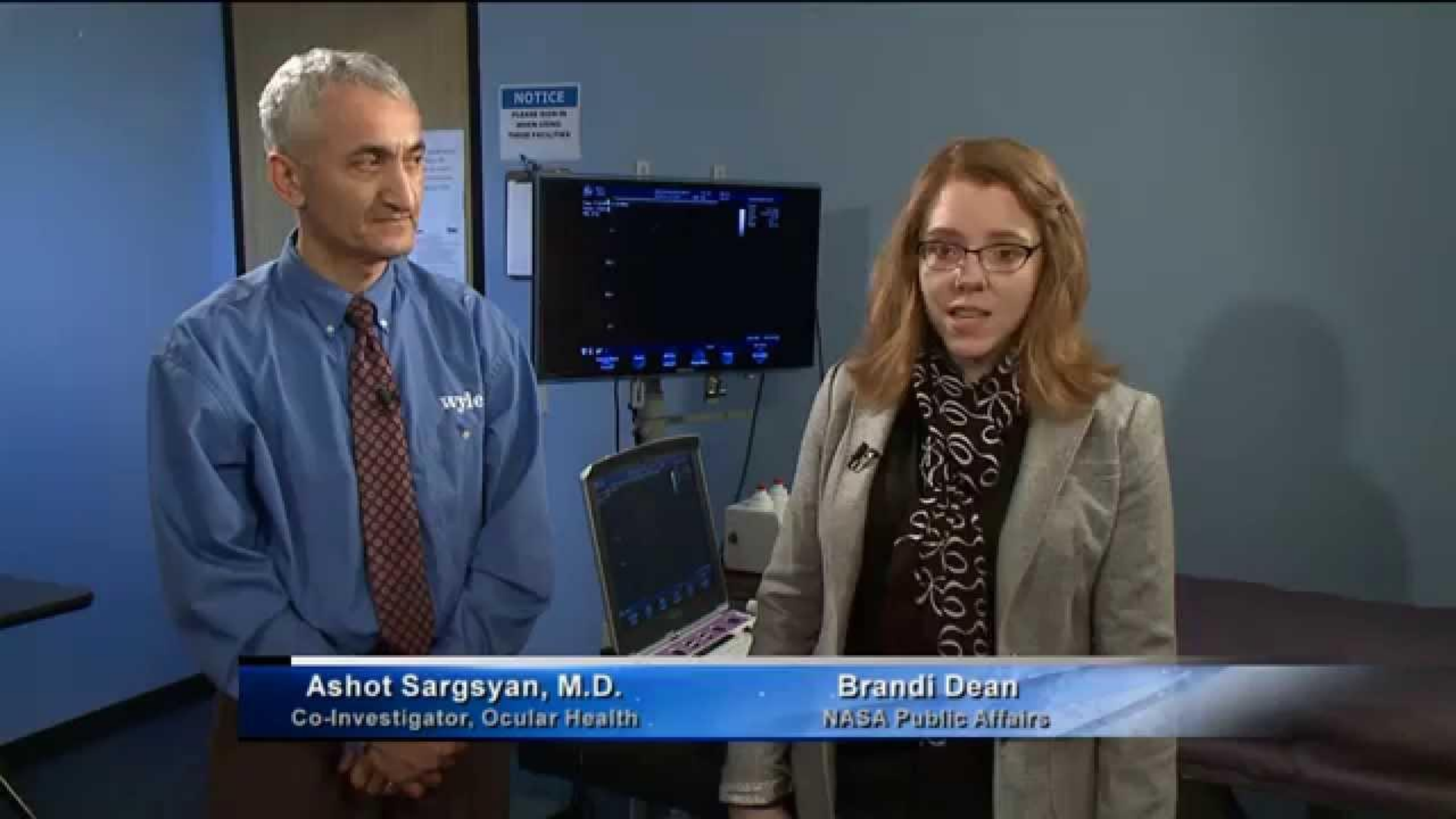
NOTICE
Ashot Sargsyan, M.D.
Co-Investigator, Ocular Health
Brandi Dean
NASA Public Affairs

1
00:00:05,110 --> 00:00:03,189
many astronauts are coming back from

2
00:00:07,909 --> 00:00:05,120
long duration missions to iss with

3
00:00:10,390 --> 00:00:07,919
diminished vision and station science is

4
00:00:12,150 --> 00:00:10,400
working to understand why station crew

5
00:00:14,549 --> 00:00:12,160
members take part in the ocular health

6
00:00:16,790 --> 00:00:14,559
experiment gathering data on the eyes

7
00:00:18,710 --> 00:00:16,800
and weightlessness so scientists can

8
00:00:20,550 --> 00:00:18,720
determine what's causing the vision loss

9
00:00:22,950 --> 00:00:20,560
and develop counter measures

10
00:00:24,950 --> 00:00:22,960
last week my colleague brandi dean

11
00:00:27,349 --> 00:00:24,960
showed us how the crew members conduct

12
00:00:29,750 --> 00:00:27,359
an examination using a tonometer and

13
00:00:31,830 --> 00:00:29,760

today she reports on eye exams using an

14
00:00:33,590 --> 00:00:31,840
ultrasound

15
00:00:35,590 --> 00:00:33,600
hi welcome back to the medical

16
00:00:37,990 --> 00:00:35,600
simulation laboratory just off site at

17
00:00:39,830 --> 00:00:38,000
johnson space center in houston where we

18
00:00:41,030 --> 00:00:39,840
have learned recently a little bit about

19
00:00:42,470 --> 00:00:41,040
some of the different ways that we're

20
00:00:44,069 --> 00:00:42,480
finding out about what happens to

21
00:00:45,910 --> 00:00:44,079
astronauts eyesight when they're in

22
00:00:47,830 --> 00:00:45,920
space we're back today to learn

23
00:00:49,830 --> 00:00:47,840
specifically about the ultrasound that

24
00:00:51,910 --> 00:00:49,840
the crews perform to learn more about

25
00:00:54,630 --> 00:00:51,920
that and we have with us today dr ashat

26
00:00:56,389 --> 00:00:54,640
sargissian who is an ultrasound imaging

27
00:00:58,310 --> 00:00:56,399
expert and also one of the investigators

28
00:00:59,590 --> 00:00:58,320
on several of the studies that are

29
00:01:01,270 --> 00:00:59,600
looking into that

30
00:01:03,270 --> 00:01:01,280
so thank you so much for joining us

31
00:01:05,670 --> 00:01:03,280
pleasure to be here all right well so

32
00:01:08,789 --> 00:01:05,680
why don't we start with why do we do

33
00:01:10,789 --> 00:01:08,799
ultrasounds on astronauts eyes in space

34
00:01:12,550 --> 00:01:10,799
well sound is one of the

35
00:01:15,030 --> 00:01:12,560
imaging modalities that we use on

36
00:01:17,510 --> 00:01:15,040
astronauts before during and after

37
00:01:19,630 --> 00:01:17,520
missions and this modality is very good

38
00:01:21,910 --> 00:01:19,640

for portability

39
00:01:24,149 --> 00:01:21,920
non-invasiveness and

40
00:01:26,310 --> 00:01:24,159
it's very informative while looking at a

41
00:01:28,630 --> 00:01:26,320
specific organ we're talking about the

42
00:01:31,109 --> 00:01:28,640
eye it was one of the first devices that

43
00:01:32,789 --> 00:01:31,119
we used for this problem and

44
00:01:34,710 --> 00:01:32,799
the reason being

45
00:01:36,710 --> 00:01:34,720
it is just best suited to look at

46
00:01:38,630 --> 00:01:36,720
certain areas of the eye and best with

47
00:01:41,030 --> 00:01:38,640
it for some measurements

48
00:01:43,270 --> 00:01:41,040
that we can conduct and in general

49
00:01:45,350 --> 00:01:43,280
ultrasound is easily

50
00:01:47,749 --> 00:01:45,360
easily transmittable so we can get a

51
00:01:49,590 --> 00:01:47,759
real-time video from the space station

52
00:01:51,749 --> 00:01:49,600
we can guide the crew members during the

53
00:01:54,950 --> 00:01:51,759
procedure actually we do not use too

54
00:01:56,950 --> 00:01:54,960
much time doing it but most importantly

55
00:01:58,469 --> 00:01:56,960
again is the information that we derive

56
00:02:00,469 --> 00:01:58,479
out of those images what kind of

57
00:02:01,749 --> 00:02:00,479
information do you get

58
00:02:04,230 --> 00:02:01,759
the information

59
00:02:07,590 --> 00:02:04,240
received by ultrasound imaging

60
00:02:09,430 --> 00:02:07,600
is twofold one aspect of it is structure

61
00:02:11,029 --> 00:02:09,440
or anatomy

62
00:02:12,710 --> 00:02:11,039
using the eye model here i can

63
00:02:14,949 --> 00:02:12,720

demonstrate

64
00:02:16,710 --> 00:02:14,959
we measure for example the distance

65
00:02:18,630 --> 00:02:16,720
between the very front of the eye and

66
00:02:19,670 --> 00:02:18,640
the back of the eye

67
00:02:21,589 --> 00:02:19,680
this way

68
00:02:23,510 --> 00:02:21,599
we can monitor this distance and turns

69
00:02:25,670 --> 00:02:23,520
out in some crew members this distance

70
00:02:27,750 --> 00:02:25,680
becomes shorter during the mission

71
00:02:30,150 --> 00:02:27,760
progressively shorter and if this

72
00:02:32,070 --> 00:02:30,160
distance makes becomes shorter the

73
00:02:34,869 --> 00:02:32,080
subject needs to wear the reading

74
00:02:35,670 --> 00:02:34,879
glasses to to see well and some subjects

75
00:02:37,670 --> 00:02:35,680
who

76
00:02:39,030 --> 00:02:37,680
use glasses for distant vision have to

77
00:02:40,710 --> 00:02:39,040
throw them away because they don't need

78
00:02:42,790 --> 00:02:40,720
them anymore because this distance is

79
00:02:44,710 --> 00:02:42,800
naturally shorter so there is some

80
00:02:47,270 --> 00:02:44,720
silver lining in some crew members but

81
00:02:49,190 --> 00:02:47,280
generally it's a sign of concern so i

82
00:02:50,710 --> 00:02:49,200
know you've done a number of these exams

83
00:02:52,070 --> 00:02:50,720
or had the crew do a number of the exams

84
00:02:54,470 --> 00:02:52,080
on orbit have you been able to collect

85
00:02:56,229 --> 00:02:54,480
some good data so far besides looking at

86
00:02:58,070 --> 00:02:56,239
the anatomy and structure we also look

87
00:03:01,110 --> 00:02:58,080
at physiology

88
00:03:02,070 --> 00:03:01,120

in broader term specifically we look at

89
00:03:04,550 --> 00:03:02,080
at the

90
00:03:06,390 --> 00:03:04,560
flow of blood in and out of the globe we

91
00:03:07,910 --> 00:03:06,400
have multiple vessels as you can see on

92
00:03:09,509 --> 00:03:07,920
this model

93
00:03:11,589 --> 00:03:09,519
and the reds are arteries and the

94
00:03:14,229 --> 00:03:11,599
yellows are nerves actually but there

95
00:03:16,470 --> 00:03:14,239
are four veins coming out of the globe

96
00:03:18,710 --> 00:03:16,480
and then there is a pair of vessels that

97
00:03:20,869 --> 00:03:18,720
comes out of through the optic nerve

98
00:03:23,350 --> 00:03:20,879
right in the central canal of the optic

99
00:03:25,509 --> 00:03:23,360
nerve so these are tiny tiny vessels

100
00:03:27,670 --> 00:03:25,519
those are now less than a millimeter in

101
00:03:30,470 --> 00:03:27,680
diameter however this technology allows

102
00:03:32,309 --> 00:03:30,480
us to not accurately describe the

103
00:03:33,830 --> 00:03:32,319
character of the flow inside of those

104
00:03:36,630 --> 00:03:33,840
vessels and the

105
00:03:37,910 --> 00:03:36,640
actual velocities of flow of the blood

106
00:03:39,110 --> 00:03:37,920
um

107
00:03:42,149 --> 00:03:39,120
this is

108
00:03:44,390 --> 00:03:42,159
more a scientific aspect of sound

109
00:03:47,270 --> 00:03:44,400
imaging where we're we're trying to tie

110
00:03:49,990 --> 00:03:47,280
the changes in the eye to the

111
00:03:52,309 --> 00:03:50,000
changes that body in the body in general

112
00:03:55,350 --> 00:03:52,319
undergoes including shift of fluids

113
00:03:57,509 --> 00:03:55,360

including some swelling of the upper

114
00:03:59,190 --> 00:03:57,519
part of the body and difficulty in

115
00:04:01,350 --> 00:03:59,200
venous drainage from some parts of the

116
00:04:03,830 --> 00:04:01,360
body including the eye so that's one of

117
00:04:06,710 --> 00:04:03,840
the hypotheses that one of the multiple

118
00:04:08,630 --> 00:04:06,720
factors we're dealing with is the

119
00:04:10,149 --> 00:04:08,640
changes in the blood flow

120
00:04:11,190 --> 00:04:10,159
can you tell us what we're looking at

121
00:04:12,949 --> 00:04:11,200
here

122
00:04:15,589 --> 00:04:12,959
this is the ultrasound scanner actually

123
00:04:17,590 --> 00:04:15,599
an exa exact copy of what we have on the

124
00:04:20,550 --> 00:04:17,600
international space station it's one of

125
00:04:22,710 --> 00:04:20,560
the most used research hardware actually

126
00:04:25,030 --> 00:04:22,720
we fly these days

127
00:04:27,189 --> 00:04:25,040
you can notice that the keyboard is uh

128
00:04:29,510 --> 00:04:27,199
unlike most medical devices it's very

129
00:04:30,710 --> 00:04:29,520
colorful there's a reason for that we

130
00:04:32,790 --> 00:04:30,720
have made it

131
00:04:34,710 --> 00:04:32,800
color coded so that we can remotely

132
00:04:36,790 --> 00:04:34,720
guide the crew members to the right

133
00:04:39,270 --> 00:04:36,800
button more easily for example this

134
00:04:41,670 --> 00:04:39,280
would be a purple two up this would be a

135
00:04:43,510 --> 00:04:41,680
pink two this would be a green four and

136
00:04:45,909 --> 00:04:43,520
so on okay so it makes the remote

137
00:04:48,390 --> 00:04:45,919
guidance much easier to perform why

138
00:04:50,550 --> 00:04:48,400

don't you show me what we do with this

139
00:04:53,189 --> 00:04:50,560
all right you're in a position similar

140
00:04:55,590 --> 00:04:53,199
to an astronaut about to be examined on

141
00:04:57,990 --> 00:04:55,600
the international space station and

142
00:05:00,469 --> 00:04:58,000
there will be a second astronaut uh to

143
00:05:03,110 --> 00:05:00,479
assist with the machine and uh so on so

144
00:05:05,110 --> 00:05:03,120
i will be the assisting okay remember in

145
00:05:07,749 --> 00:05:05,120
this case i'm handing you a probe

146
00:05:08,790 --> 00:05:07,759
already with gel all right i think layer

147
00:05:12,550 --> 00:05:08,800
of gel

148
00:05:14,950 --> 00:05:12,560
and you take off your glasses and

149
00:05:17,270 --> 00:05:14,960
center yourself relative to the screen

150
00:05:19,110 --> 00:05:17,280
okay do a chin up

151
00:05:21,350 --> 00:05:19,120
position with

152
00:05:23,830 --> 00:05:21,360
the probe going on to your upper eyelid

153
00:05:27,670 --> 00:05:23,840
okay gently ease it on the upper eyelid

154
00:05:31,350 --> 00:05:29,510
once you apply the probe we can see the

155
00:05:33,670 --> 00:05:31,360
circle the black circle on the screen

156
00:05:35,590 --> 00:05:33,680
that takes up most of the image is the

157
00:05:37,189 --> 00:05:35,600
eye globe actually okay you can

158
00:05:40,790 --> 00:05:37,199
appreciate the curvature of the back of

159
00:05:42,629 --> 00:05:40,800
the eye and now if you're a tilt the

160
00:05:45,749 --> 00:05:42,639
probe with the cable end of the probe

161
00:05:47,830 --> 00:05:45,759
towards your feet very very slowly

162
00:05:50,550 --> 00:05:47,840
there we go that's a that's a very good

163
00:05:54,230 --> 00:05:50,560

view the optic nerve coming and meeting

164
00:05:56,790 --> 00:05:54,240
the eye here is where the 1.2 million uh

165
00:05:58,870 --> 00:05:56,800
nerve fibers are located in the bundle

166
00:06:01,189 --> 00:05:58,880
here inside the central part of this

167
00:06:03,909 --> 00:06:01,199
tribe but we're very interested in the

168
00:06:05,670 --> 00:06:03,919
gray zone in both sides of this dark

169
00:06:07,909 --> 00:06:05,680
stripe which is the space that

170
00:06:10,230 --> 00:06:07,919
communicates with the intracranial space

171
00:06:13,110 --> 00:06:10,240
and pressure inside the skull propagates

172
00:06:15,270 --> 00:06:13,120
all the way to reach the globe here so

173
00:06:17,270 --> 00:06:15,280
this diameter is very important also

174
00:06:19,270 --> 00:06:17,280
important is the distance between the

175
00:06:24,870 --> 00:06:19,280
front of the eye and the back

176
00:06:29,990 --> 00:06:27,909
respectively for these uh three values

177
00:06:31,990 --> 00:06:30,000
tell us that something's going not

178
00:06:34,070 --> 00:06:32,000
perfect with the given subject well how

179
00:06:36,870 --> 00:06:34,080
does my eye look all right it looks

180
00:06:38,070 --> 00:06:36,880
perfect gorgeous and unchanged

181
00:06:40,710 --> 00:06:38,080
all right

182
00:06:42,070 --> 00:06:40,720
so have you been able to draw some some

183
00:06:43,270 --> 00:06:42,080
conclusions based on what you've learned

184
00:06:45,909 --> 00:06:43,280
so far

185
00:06:48,390 --> 00:06:45,919
we do see changes in the structure we do

186
00:06:50,070 --> 00:06:48,400
see some

187
00:06:51,270 --> 00:06:50,080
progression and regression as the

188
00:06:52,870 --> 00:06:51,280

mission

189
00:06:54,870 --> 00:06:52,880
continues and

190
00:06:56,950 --> 00:06:54,880
gets completed eventually

191
00:06:58,790 --> 00:06:56,960
most of the changes return back to their

192
00:07:01,189 --> 00:06:58,800
pre-applied levels

193
00:07:02,710 --> 00:07:01,199
we do see for example

194
00:07:04,950 --> 00:07:02,720
changing the curvature of the back of

195
00:07:06,550 --> 00:07:04,960
the eye that's we call it flattening

196
00:07:08,230 --> 00:07:06,560
although it's not really flat flat in

197
00:07:10,550 --> 00:07:08,240
most cases but it's flattening over the

198
00:07:12,309 --> 00:07:10,560
back of the eye which may be an

199
00:07:14,150 --> 00:07:12,319
indicator that there is a disbalance

200
00:07:16,469 --> 00:07:14,160
between the pressures inside the globe

201
00:07:19,670 --> 00:07:16,479
and behind the globe

202
00:07:21,830 --> 00:07:19,680
the thing is uh the fact is that the

203
00:07:24,230 --> 00:07:21,840
space between the sheet and the nerve

204
00:07:26,629 --> 00:07:24,240
itself is pressurized and the pressure

205
00:07:29,110 --> 00:07:26,639
equals the pressure inside the skull so

206
00:07:31,350 --> 00:07:29,120
if the intracranial pressure rises that

207
00:07:32,710 --> 00:07:31,360
reflects the pressure propagates all the

208
00:07:34,790 --> 00:07:32,720
way to the globe

209
00:07:37,029 --> 00:07:34,800
and therefore changes the balance of

210
00:07:38,390 --> 00:07:37,039
pressures right at this interface

211
00:07:41,589 --> 00:07:38,400
so one of those things that we can

212
00:07:43,430 --> 00:07:41,599
describe well with ultrasound is that

213
00:07:44,869 --> 00:07:43,440

shape of the back of the globe and the

214
00:07:47,670 --> 00:07:44,879
diameter of the

215
00:07:50,790 --> 00:07:47,680
nerve so those things together combined

216
00:07:52,150 --> 00:07:50,800
tell us something is happening okay so

217
00:07:55,110 --> 00:07:52,160
based on that what you've already

218
00:07:58,390 --> 00:07:55,120
learned what do you do next you keep

219
00:08:00,710 --> 00:07:58,400
gathering the same data or add to it or

220
00:08:03,110 --> 00:08:00,720
we do this and produce data for flight

221
00:08:06,070 --> 00:08:03,120
surgeons to use immediately so the

222
00:08:07,909 --> 00:08:06,080
immediate use for the data at least some

223
00:08:09,670 --> 00:08:07,919
of the data

224
00:08:11,430 --> 00:08:09,680
is part of the clinical practice of

225
00:08:13,430 --> 00:08:11,440
space medicine nowadays so the flight

226
00:08:14,710 --> 00:08:13,440
surgeon looks at those numbers and looks

227
00:08:15,990 --> 00:08:14,720
at the trends

228
00:08:17,749 --> 00:08:16,000
and

229
00:08:20,790 --> 00:08:17,759
somehow modifies the surveillance

230
00:08:22,309 --> 00:08:20,800
intensity how frequently they look uh do

231
00:08:24,309 --> 00:08:22,319
they do

232
00:08:26,950 --> 00:08:24,319
additional testing in shorter time

233
00:08:28,869 --> 00:08:26,960
intervals and so on so that's the

234
00:08:31,830 --> 00:08:28,879
immediate clinical monitoring of the

235
00:08:34,310 --> 00:08:31,840
crew member however

236
00:08:36,550 --> 00:08:34,320
the long-term analysis of the cohort as

237
00:08:38,630 --> 00:08:36,560
a whole will give us more information

238
00:08:40,790 --> 00:08:38,640

about

239
00:08:42,550 --> 00:08:40,800
factors of predisposition why do some

240
00:08:44,790 --> 00:08:42,560
crew members develop vision changes and

241
00:08:46,710 --> 00:08:44,800
others don't and

242
00:08:49,350 --> 00:08:46,720
finally we correlate our ultrasound

243
00:08:52,070 --> 00:08:49,360
imaging data with other data so we have

244
00:08:55,269 --> 00:08:52,080
a suite of different diagnostic methods

245
00:08:57,430 --> 00:08:55,279
so we have the luxury of statistical

246
00:08:59,590 --> 00:08:57,440
analysis that tells us

247
00:09:01,430 --> 00:08:59,600
um

248
00:09:04,550 --> 00:09:01,440
pretty individualized

249
00:09:07,110 --> 00:09:04,560
picture of what's going on we do need

250
00:09:09,509 --> 00:09:07,120
more subjects though so that scientific

251
00:09:11,269 --> 00:09:09,519
aspect of of this work

252
00:09:12,710 --> 00:09:11,279
will take some time

253
00:09:15,030 --> 00:09:12,720
but picture

254
00:09:16,310 --> 00:09:15,040
papers are already coming out

255
00:09:18,150 --> 00:09:16,320
all right well thank you so much for

256
00:09:20,790 --> 00:09:18,160
talking with us again this was dr ashto

257
00:09:22,550 --> 00:09:20,800
sargusian who is an ultrasound imaging

258
00:09:24,150 --> 00:09:22,560
expert and one of the principal

259
00:09:25,910 --> 00:09:24,160
investigators of several of the studies