



1  
00:00:09,509 --> 00:00:07,829  
one of the many things we've learned by

2  
00:00:11,270 --> 00:00:09,519  
living and working on the space station

3  
00:00:13,110 --> 00:00:11,280  
for months at a time is that more than

4  
00:00:15,270 --> 00:00:13,120  
half of the astronauts have returned to

5  
00:00:16,790 --> 00:00:15,280  
earth with vision changes a new

6  
00:00:19,029 --> 00:00:16,800  
investigation is learning how space

7  
00:00:21,750 --> 00:00:19,039  
flight and something called fluid shifts

8  
00:00:23,830 --> 00:00:21,760  
affects vision and eye shape lori meigs

9  
00:00:25,670 --> 00:00:23,840  
is at the payload operations integration

10  
00:00:30,470 --> 00:00:25,680  
center at nasa's marshall space flight

11  
00:00:34,870 --> 00:00:32,150  
have you ever had the blood rush to your

12  
00:00:36,389 --> 00:00:34,880  
head well crew members have that same

13  
00:00:38,389 --> 00:00:36,399

feeling once they arrive at the space

14

00:00:40,470 --> 00:00:38,399

station much is the same for folks who

15

00:00:42,630 --> 00:00:40,480

are suffering from swelling in the brain

16

00:00:44,950 --> 00:00:42,640

or confined to bed rest that's because

17

00:00:47,110 --> 00:00:44,960

all of the fluid tends to shift up well

18

00:00:48,709 --> 00:00:47,120

now a new investigation is looking at at

19

00:00:50,709 --> 00:00:48,719

whether these fluid shifts are causing

20

00:00:52,950 --> 00:00:50,719

vision problems for astronauts when they

21

00:00:54,549 --> 00:00:52,960

return to earth results from this study

22

00:00:56,389 --> 00:00:54,559

could help them to develop

23

00:00:57,750 --> 00:00:56,399

countermeasures for folks here on earth

24

00:00:59,910 --> 00:00:57,760

as well as the astronauts with vision

25

00:01:01,990 --> 00:00:59,920

damage i had the opportunity to visit

26  
00:01:03,750 --> 00:01:02,000  
the lab where the crew members undergo

27  
00:01:08,070 --> 00:01:03,760  
testing for this investigation before

28  
00:01:11,510 --> 00:01:09,670  
we're talking fluid shifts mike stinger

29  
00:01:13,270 --> 00:01:11,520  
is here we're in the cardiovascular lab

30  
00:01:14,870 --> 00:01:13,280  
at johnson space center mike

31  
00:01:16,789 --> 00:01:14,880  
fluid shifts i mean is that what we

32  
00:01:18,310 --> 00:01:16,799  
really think it is how your fluids are

33  
00:01:19,590 --> 00:01:18,320  
moving around your body that's pretty

34  
00:01:21,350 --> 00:01:19,600  
much what it sounds like we're

35  
00:01:23,429 --> 00:01:21,360  
investigating the impact of the headword

36  
00:01:24,789 --> 00:01:23,439  
fluid that's caused by space flight on

37  
00:01:26,230 --> 00:01:24,799  
this ocular syndrome this visual

38  
00:01:28,390 --> 00:01:26,240

impairment and intracranial pressure

39

00:01:29,990 --> 00:01:28,400

syndrome one of the primary hypotheses

40

00:01:32,149 --> 00:01:30,000

is that you get this headword fluid

41

00:01:33,670 --> 00:01:32,159

shift and that the subsequent results of

42

00:01:35,830 --> 00:01:33,680

that fluid shift are causing an

43

00:01:37,990 --> 00:01:35,840

elevation into intracranial pressure

44

00:01:40,469 --> 00:01:38,000

just causing swelling of the back of the

45

00:01:41,830 --> 00:01:40,479

eyeball which is affecting vision

46

00:01:43,109 --> 00:01:41,840

so when the crew members come back

47

00:01:45,270 --> 00:01:43,119

they've been having some vision problems

48

00:01:46,550 --> 00:01:45,280

and that's a really big thing for the

49

00:01:48,389 --> 00:01:46,560

space station program right now to

50

00:01:50,069 --> 00:01:48,399

figure out why this is happening right

51  
00:01:51,190 --> 00:01:50,079  
so one of the hypotheses is that it's

52  
00:01:52,630 --> 00:01:51,200  
entertaining our pressure no one's

53  
00:01:55,350 --> 00:01:52,640  
actually investigated this so this is

54  
00:01:57,030 --> 00:01:55,360  
the first experiment to look at

55  
00:01:58,469 --> 00:01:57,040  
the blood flow going up into the head

56  
00:02:01,109 --> 00:01:58,479  
where it's a very comprehensive

57  
00:02:02,870 --> 00:02:01,119  
experiment where we're looking at all

58  
00:02:04,469 --> 00:02:02,880  
the blood flow pathways into the brain

59  
00:02:06,310 --> 00:02:04,479  
what what fluid is doing in the brain

60  
00:02:07,830 --> 00:02:06,320  
how it's uh filtering out of the blood

61  
00:02:10,070 --> 00:02:07,840  
vessels going into cells into the

62  
00:02:12,630 --> 00:02:10,080  
interstitial spaces we're also

63  
00:02:14,550 --> 00:02:12,640

investigating how the human body

64

00:02:15,750 --> 00:02:14,560

changes its venous drainage strategies

65

00:02:17,270 --> 00:02:15,760

because there's no gravity pulling the

66

00:02:19,110 --> 00:02:17,280

blood back to your heart

67

00:02:21,830 --> 00:02:19,120

one of the hypotheses is that venous

68

00:02:23,510 --> 00:02:21,840

congestion is causing this syndrome and

69

00:02:25,510 --> 00:02:23,520

so we're looking at the various drainage

70

00:02:27,270 --> 00:02:25,520

pathways out of the head as well all

71

00:02:29,030 --> 00:02:27,280

right can i see how it might all work

72

00:02:30,630 --> 00:02:29,040

here when you test the subjects

73

00:02:32,070 --> 00:02:30,640

absolutely all right

74

00:02:34,070 --> 00:02:32,080

so i feel like a test subject now i'm

75

00:02:36,390 --> 00:02:34,080

like now what's happening so right now

76

00:02:39,990 --> 00:02:36,400

you're getting a bilateral ultrasound

77

00:02:42,229 --> 00:02:40,000

scans david is scanning your carotid

78

00:02:44,470 --> 00:02:42,239

jugular vein and tim over here scanning

79

00:02:45,830 --> 00:02:44,480

your carotid artery so one side we're

80

00:02:46,949 --> 00:02:45,840

imaging the blood going into your head

81

00:02:48,710 --> 00:02:46,959

and the other side we're imaging the

82

00:02:50,229 --> 00:02:48,720

blood draining out of your head so right

83

00:02:51,910 --> 00:02:50,239

now you're laying flat on your back and

84

00:02:54,470 --> 00:02:51,920

so we want to investigate everyone's

85

00:02:55,430 --> 00:02:54,480

individual strategy for how they manage

86

00:03:02,710 --> 00:02:55,440

this blood flow so i'm gonna touch you

87

00:03:07,830 --> 00:03:05,910

so there that's 15 degrees head down and

88

00:03:09,190 --> 00:03:07,840

we would um

89

00:03:11,110 --> 00:03:09,200

measure blood going into your head at

90

00:03:12,550 --> 00:03:11,120

this angle and then definitely go in

91

00:03:14,390 --> 00:03:12,560

there it's definitely going there and

92

00:03:15,830 --> 00:03:14,400

and david will see the jugular vein in

93

00:03:18,229 --> 00:03:15,840

your neck and gorge

94

00:03:19,670 --> 00:03:18,239

as it starts to back up a little bit and

95

00:03:21,030 --> 00:03:19,680

during a natural experiment we'd have a

96

00:03:22,869 --> 00:03:21,040

third stenographer

97

00:03:24,309 --> 00:03:22,879

scanning your eyeball right now

98

00:03:26,550 --> 00:03:24,319

and looking at the blood flowing in and

99

00:03:27,990 --> 00:03:26,560

out of your eye as well as in your brain

100

00:03:31,030 --> 00:03:28,000

we would have you in this posture for

101  
00:03:33,509 --> 00:03:31,040  
about 30 minutes oh my yes so so we're

102  
00:03:35,750 --> 00:03:33,519  
getting a time course of changes as well

103  
00:03:37,910 --> 00:03:35,760  
um and we have other we have other

104  
00:03:39,270 --> 00:03:37,920  
modalities that we'd like to show you as

105  
00:03:40,470 --> 00:03:39,280  
well so we'd like we'd be taking

106  
00:03:42,470 --> 00:03:40,480  
pictures of the back of your eye right

107  
00:03:43,990 --> 00:03:42,480  
now to see how the choroid

108  
00:03:45,430 --> 00:03:44,000  
the vascular network in the back of your

109  
00:03:46,550 --> 00:03:45,440  
eye how it swells or how it doesn't

110  
00:03:48,630 --> 00:03:46,560  
swell

111  
00:03:50,789 --> 00:03:48,640  
changes in the nerve fiber layer in the

112  
00:03:53,509 --> 00:03:50,799  
back of your eye we also measure eye

113  
00:03:55,110 --> 00:03:53,519

pressure using a rebound tenometer and

114

00:03:56,550 --> 00:03:55,120

we also have some non-invasive measures

115

00:03:57,990 --> 00:03:56,560

of intracranial pressure that we can

116

00:03:59,589 --> 00:03:58,000

show you as well that we would be

117

00:04:01,670 --> 00:03:59,599

measuring at this time

118

00:04:04,309 --> 00:04:01,680

we think that different astronauts

119

00:04:05,910 --> 00:04:04,319

respond differently to the headword

120

00:04:07,589 --> 00:04:05,920

fluid shift which is why some astronauts

121

00:04:09,270 --> 00:04:07,599

develop more severe symptoms of vip and

122

00:04:11,589 --> 00:04:09,280

others do not so how many are going

123

00:04:13,270 --> 00:04:11,599

through this

124

00:04:15,110 --> 00:04:13,280

process that i'm going through right now

125

00:04:17,189 --> 00:04:15,120

we're going to investigate 10 astronauts

126

00:04:19,349 --> 00:04:17,199

so far we've already done uh pre-flight

127

00:04:21,030 --> 00:04:19,359

data collection on three of them so our

128

00:04:23,510 --> 00:04:21,040

first two uh in flight estimates are the

129

00:04:25,749 --> 00:04:23,520

two one-year crew members

130

00:04:28,390 --> 00:04:25,759

so what's he doing now mike so this is a

131

00:04:30,710 --> 00:04:28,400

spectralis oct camera optical coherence

132

00:04:32,230 --> 00:04:30,720

tomography you probably had this done at

133

00:04:34,070 --> 00:04:32,240

your annual eye exam but you'd be

134

00:04:35,270 --> 00:04:34,080

sitting upright with your face and a

135

00:04:37,110 --> 00:04:35,280

chin rest and your forehead pressed

136

00:04:38,629 --> 00:04:37,120

against the forehead rest he's taking

137

00:04:41,030 --> 00:04:38,639

really detailed pictures of the back of

138

00:04:44,230 --> 00:04:41,040

your eye

139

00:04:46,070 --> 00:04:44,240

and this is a replica this is a camera

140

00:04:47,110 --> 00:04:46,080

that we have on station right now so

141

00:04:48,390 --> 00:04:47,120

they have it

142

00:04:50,870 --> 00:04:48,400

up on station now they have the chin

143

00:04:52,790 --> 00:04:50,880

rest um this this particular device is

144

00:04:55,590 --> 00:04:52,800

unique in that we have a um one of a

145

00:04:56,469 --> 00:04:55,600

kind boom arm that allows him to orient

146

00:04:57,909 --> 00:04:56,479

the camera

147

00:04:59,030 --> 00:04:57,919

um in such a position that he can get

148

00:05:00,950 --> 00:04:59,040

these images while you're laying on your

149

00:05:02,390 --> 00:05:00,960

back and you can also do it while you're

150

00:05:03,510 --> 00:05:02,400

laying head down so while your head down

151  
00:05:06,150 --> 00:05:03,520  
and when you have that rush of fluid to

152  
00:05:07,670 --> 00:05:06,160  
your head we can see how the fluid

153  
00:05:10,230 --> 00:05:07,680  
engorgement in the back of the eye is

154  
00:05:12,469 --> 00:05:10,240  
called the choroid how that how that's

155  
00:05:13,990 --> 00:05:12,479  
different in different astronauts so we

156  
00:05:16,469 --> 00:05:14,000  
think that the different response to

157  
00:05:18,710 --> 00:05:16,479  
that headword fluid shift may predict

158  
00:05:20,790 --> 00:05:18,720  
the severity of vip

159  
00:05:22,150 --> 00:05:20,800  
and who gets it who gets it who doesn't

160  
00:05:23,189 --> 00:05:22,160  
yes

161  
00:05:24,870 --> 00:05:23,199  
one of the interventions that we're

162  
00:05:27,270 --> 00:05:24,880  
interested in is lower body negative

163  
00:05:28,629 --> 00:05:27,280

pressure to reverse the head where it

164

00:05:30,870 --> 00:05:28,639

affects these fluid shifts in space

165

00:05:32,310 --> 00:05:30,880

flight so we will move a lot of our

166

00:05:35,110 --> 00:05:32,320

hardware from the u.s segment over to

167

00:05:37,029 --> 00:05:35,120

the russian segment including the oct

168

00:05:38,390 --> 00:05:37,039

but the base is too big to transport so

169

00:05:39,510 --> 00:05:38,400

we're going to free float the camera you

170

00:05:41,189 --> 00:05:39,520

just the astronaut will just hold it in

171

00:05:42,950 --> 00:05:41,199

front of their face

172

00:05:45,110 --> 00:05:42,960

while another astronaut runs the

173

00:05:46,950 --> 00:05:45,120

computer to take pictures of the back of

174

00:05:48,790 --> 00:05:46,960

the eye while we're trying to pull the

175

00:05:50,870 --> 00:05:48,800

fluid back out of your head

176

00:05:52,870 --> 00:05:50,880

so we also think that some astronauts

177

00:05:54,870 --> 00:05:52,880

will respond better to the lbmp

178

00:05:57,270 --> 00:05:54,880

intervention than others uh-oh he has

179

00:05:58,469 --> 00:05:57,280

something else so he's got a rebound

180

00:06:02,390 --> 00:05:58,479

tonometer

181

00:06:04,070 --> 00:06:02,400

this measures the pressure in your eye

182

00:06:05,430 --> 00:06:04,080

so there's

183

00:06:06,790 --> 00:06:05,440

the the difference between the pressure

184

00:06:08,629 --> 00:06:06,800

in your brain and the pressure in your

185

00:06:11,590 --> 00:06:08,639

eyes across is called the trans laminar

186

00:06:13,510 --> 00:06:11,600

pressure gradient that that affects

187

00:06:15,830 --> 00:06:13,520

um the severity of the symptoms we think

188

00:06:17,029 --> 00:06:15,840

you get so he has to come in here to do

189

00:06:18,629 --> 00:06:17,039

this

190

00:06:20,629 --> 00:06:18,639

it doesn't hurt you won't feel a thing

191

00:06:22,550 --> 00:06:20,639

so i've heard that before this little

192

00:06:23,590 --> 00:06:22,560

probe right here is going to bounce off

193

00:06:25,670 --> 00:06:23,600

the front of your eye and it's going to

194

00:06:28,550 --> 00:06:25,680

measure the pressure okay okay so you

195

00:06:30,230 --> 00:06:28,560

can just stare straight at it

196

00:06:39,909 --> 00:06:30,240

go ahead and blink from it

197

00:06:44,150 --> 00:06:42,070

you just performed seven measures

198

00:06:45,909 --> 00:06:44,160

uh did you that was uncomfortable at all

199

00:06:47,990 --> 00:06:45,919

or no not really just you know when you

200

00:06:50,230 --> 00:06:48,000

have something pointing at your eyes

201  
00:06:51,350 --> 00:06:50,240  
it's a little so that's also we call

202  
00:06:53,110 --> 00:06:51,360  
that a non-invasive measure of

203  
00:06:54,710 --> 00:06:53,120  
intraocular pressure

204  
00:06:55,990 --> 00:06:54,720  
yeah and so we would do that three or

205  
00:06:57,189 --> 00:06:56,000  
four times at all with the different

206  
00:07:00,230 --> 00:06:57,199  
positions all right i'm good with one

207  
00:07:02,710 --> 00:07:00,240  
though that's good thank you

208  
00:07:05,510 --> 00:07:02,720  
thanks so so that's it as far as that's

209  
00:07:07,510 --> 00:07:05,520  
it but that's that's in a nutshell

210  
00:07:09,189 --> 00:07:07,520  
really all right

211  
00:07:11,350 --> 00:07:09,199  
i like it here on the stage check it out

212  
00:07:13,189 --> 00:07:11,360  
all right enjoy yourself

213  
00:07:15,350 --> 00:07:13,199

well that was fun thanks to the team

214

00:07:16,710 --> 00:07:15,360

there for letting us on the inside here

215

00:07:18,469 --> 00:07:16,720

at the payload operations integration

216

00:07:20,230 --> 00:07:18,479

center they're assisting with that

217

00:07:22,070 --> 00:07:20,240

final uh

218

00:07:23,430 --> 00:07:22,080

fluid shifts experiment for the first

219

00:07:25,430 --> 00:07:23,440

round for the crew member the final crew

220

00:07:27,029 --> 00:07:25,440

member undergoing that this morning

221

00:07:28,550 --> 00:07:27,039

today jimmy whitaker is the payload

222

00:07:30,629 --> 00:07:28,560

operations director leading the team

223

00:07:32,950 --> 00:07:30,639

here assisted by stephanie dudley and

224

00:07:35,510 --> 00:07:32,960

then the paycoms are chrissy stinson

225

00:07:36,870 --> 00:07:35,520

crystal morgan and cody jones that team

226

00:07:38,950 --> 00:07:36,880

they're all working hard and working