Kristie Amobi:

Hello, everyone. My name is Kristie Amobi, and I work with Xstrahl. Welcome to today's webcast. I will be the moderator for this event. Today's session will cover the application of superficial radiation therapy in small and exotic animal oncology.

For almost six decades, specialty veterinary practices all over the world have been using radiation as an important modality to treat cancer and reduce inflammation in animals. Today, we are delighted to welcome double-board certified oncology specialist Dr. Rodney Ayl from Paragon Veterinary Referrals in the United Kingdom as today's speaker.

He will discuss the role of low energy X-ray radiotherapy as an important and cost-effective treatment for skin cancer, dermatological disorders, certain types of benign disease and some palliative care in small animal medicine. Thank you for your attention. And with that, I'll hand it over to Dr. Ayl.

Dr. Rodney Ayl:

Hello. This is Rodney Ayl. And I'm here to provide this webinar on the application of superficial radiation therapy in small and exotic animal oncology. That's something I've been doing for a number of years. I started in the US. And now, I have a unit in the UK where I'm working in Wakefield and doing this type of treatment.

So for about 60 years, veterinary practices have actually had radiation therapy of some sort using it to treat cancer and inflammation in animals. Low energy X-ray radiation is a very important and useful type of radiation. It's very cost-effective, but it is limited to very superficial lesions, skin cancer, some other dermatologic disorders, certainly, a lot of benign diseases and some palliative care in both small and exotic animals.

So as we go through the talk, there will be some examples of tumours that I have treated in the past that have all responded very well. So the objectives of our SRT program is to provide the option for multi-modality protocols that will optimize patient and client care under a single roof. To use the superficial radiation therapy to treat superficial and benign lesions have to be within one, one-and-a-half centimeters of the surface as we mentioned, and it can be used as a primary treatment or an edge of a treatment post-surgery.

Also, want to develop some definitive and palliative protocols for cases that do not need to get to one of the universities or practices that offer linear accelerators which are very limited in the UK where they would have to go, certainly for much deeper and larger lesions. There are stronger orthovoltage units that can get a little deeper, but the superficial unit is exactly that, superficial.

We want to develop protocols for localized treatment, certain benign and proliferative conditions that may have become resistant to any medical therapy that's been used previously. If we can minimize the need to use a systemic medical therapy for very localized superficial lesions, then, that may be better for the patient and also to make available in a logistically easily accessible radiation modality where we can treat palliatively for any superficial lesions and again not have to go to one of the universities for a much more complicated treatment on a linear accelerator.

Histiocytomas, great responders, there's one of the benign diseases I've treated, otitis external, where we can reduce inflammation and stop the cerumen production that these ears get which irritate the patient.

So this is the superficial unit we have from Xstrahl. It's mobile or can be stationary in one area of the room. We have it in our CT room so we move it out of the way when they're using the CT, and when we are treating, we move it back into place. It's a dedicated 220-volt circuit, pretty easy to set up.

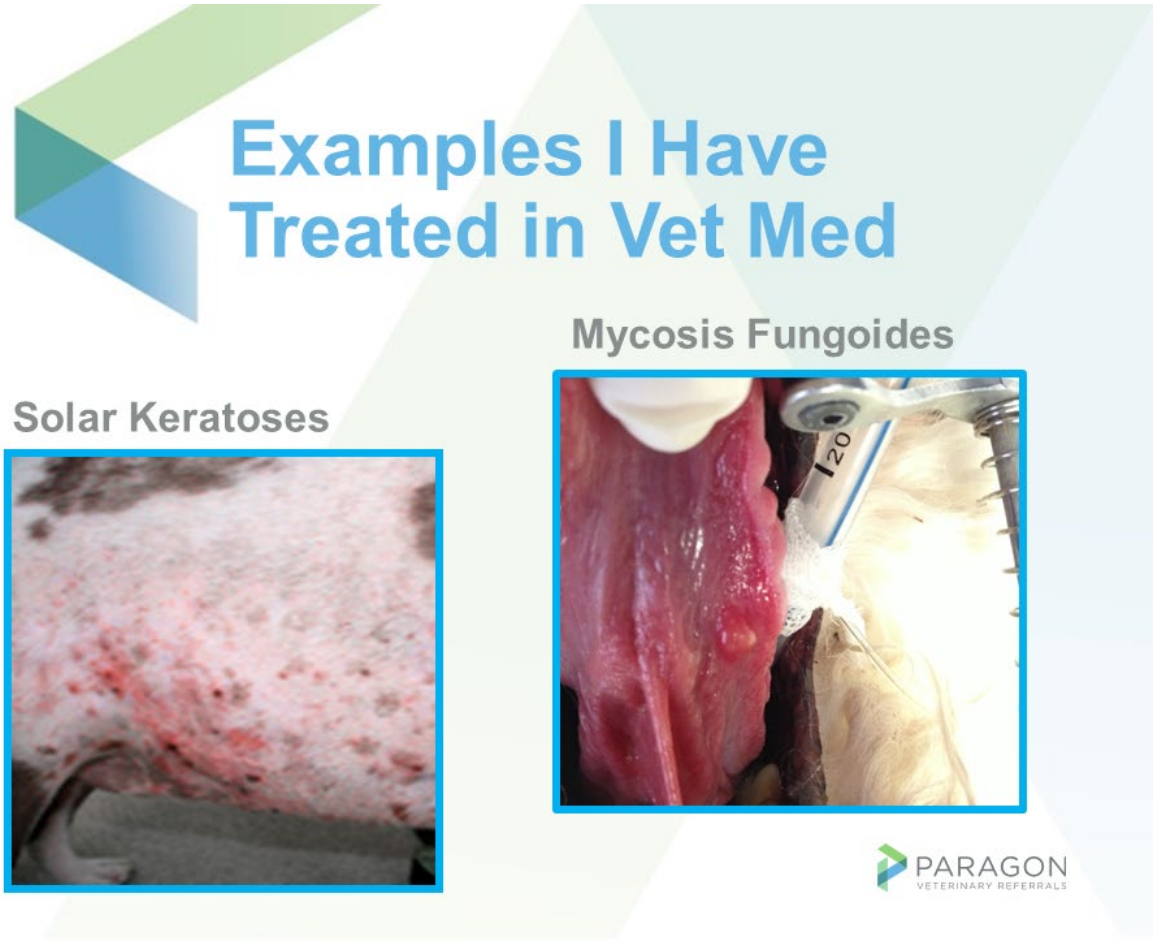
It has the robotic arm with the X-ray unit head right on the end. There are multiple cones that attach on the head, and then there is a dial that can be used to vary the energy by moving different filters into the system. These are incorporated internally so they don't have to be handled from external. It can actually be used intraoperative by sterilizing the cones.

Obviously, the surgery would have to be done where the unit is. So not optimal in our situation, but Xstrahl actually have a specific intraop unit that is being used for that kind of thing. For our CT shielding, it was sufficient for this unit so we didn't have to do anything additional.

So there's movement in two axes. It's easily fixed with a clamping system and variable cones size, they are round cones and oblong cones up to 15 centimeters in size. There's also the potential use of lead cutouts to optimize lesion coverage and maximize normal tissue shielding, and the software is worked out so that you can put cutout calculations within the software making it much easier to do the plans. So the control console and, of course, PC is in a radiation-protected area outside the CT room.

This is about the software that exists. There's the physical software, which is basically the medical physics setup. We don't have much to do with that. There's Concerto, which is the treatment setup and unit operation system. It is essentially a record-and-verify system so that it does monitor what you're doing and making sure that anybody's using the unit sets up the treatments correctly. X-Beam is

basically a treatment planning system where you can develop protocol templates for certain types of tumours that we often see in our repeatable very useful program.



A couple of other things that we do. Solar keratoses respond very nicely, especially when medical therapy is not working. And then mycosis fungoides, which is cutaneous T-cell lymphoma, that's epithelial trophic so it's very, very close to the surface, and we treat quite a few cases of these. We have treated one at Paragon.

So talking a bit more about the unit, so the tube head, as we said, is mounted on the end of the robotic arm and that too can move into axes. So it's quite easy to set up the system to treat in almost any direction with without pets lying on the CT table.

The robotic arm is very easy to move and to adjust. As we said, the clamping system is there to keep that head in position while we are treating. Treatment time can vary from less than a minute up to maybe five minutes at most. So the patients are under light general anesthesia, and it all works very well.

The dial, as we said, is on the end of the tube. We have five different filters which correspond to different energies, and there's also a warmup setting which is essentially a block that's used for the warmup and when we store the unit.

Feline acne, great treatment. It actually reduces the inflammation and itching because it deadens nerve endings, and it will stop the lick-itch-lick cycle kind of thing or lick-scratch-lick cycle with these and does - help quite a bit. Cutaneous haemangiosarcoma can be treated as well when they're in patches like this where multiple surgeries are not going to be optimal.

So just looking at some of the service features and comparison to humans, certainly has been used for decades in the humans and many radiation therapists in the human field feel that it's a superior form of external beam radiation in its ability to minimize normal tissue exposure and to maximize the effective dose to the lesion.

It actually is a more consolidated dose of radiation to superficial tumours because of the way it interacts with tissue more so than the electron therapy which is used by the linear accelerators.

A couple of other features certainly that makes it very useful for us. It's quicker, easier and cheaper as a non-invasive alternative for superficial lesions in people, especially in geriatric patients where surgery is not always a good option, and that does apply sometimes with our cases though we still have to do a light anesthetic.

It makes radiation much more available. In a good number of cases, there are a lot of these small superficial lesions that need to be treated and being available where there are time and distance constraints for owners to get to the other big facilities.

Couple others, great mast cell tumour on the end of a lip. We've actually treated one of those in our facility. Works great. Again, eosinophilic granuloma complex, that's an inflammatory lesion, also responds very well where drug therapy has not been working, or we don't want to use steroids in a diabetic patient, and we could use this.

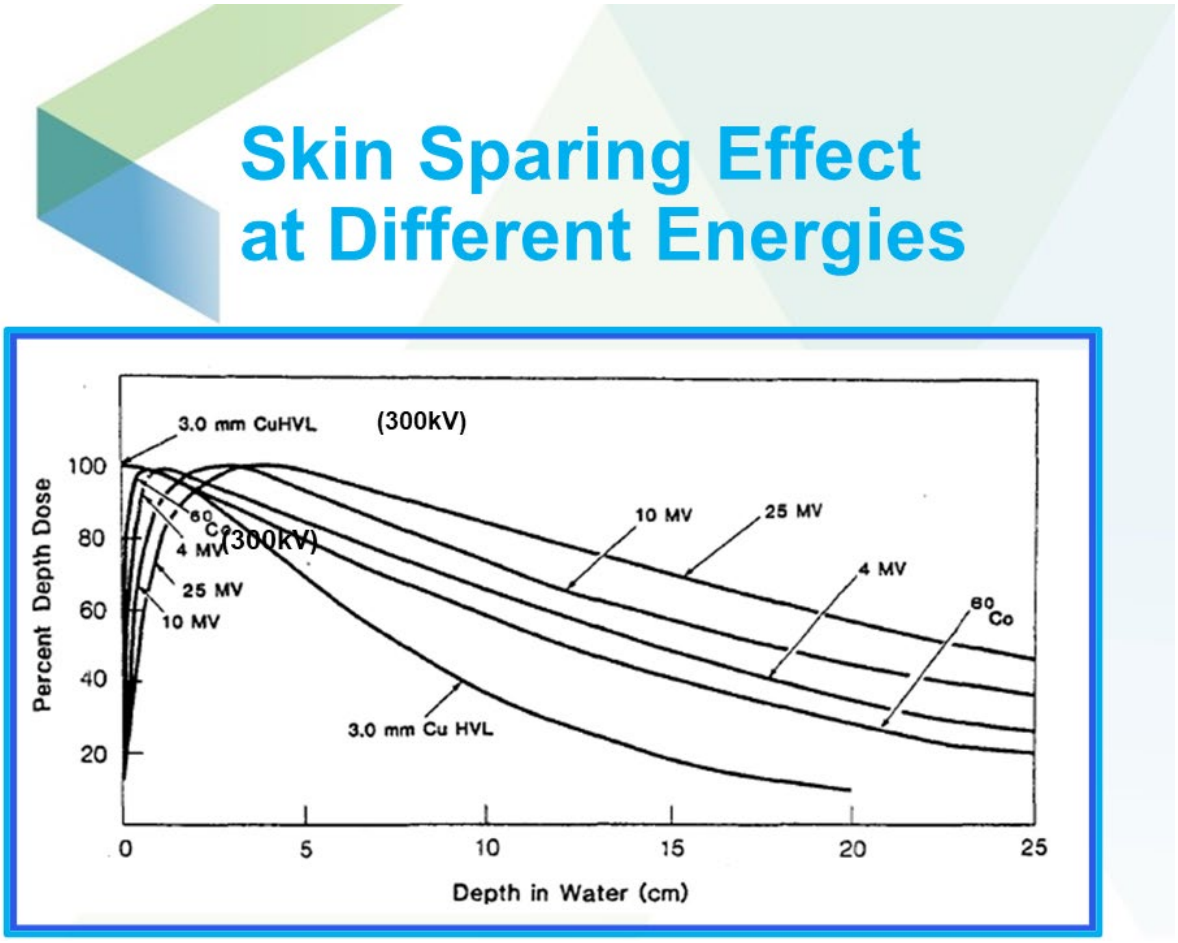
So talking about dose prescriptions, these are the intended applied doses at D_{max}, which is the maximum dose where the X-rays in this case interact with tissue. So the aim with electrons is to get a superficial dose or skin dose of 95% to 100%. That has to be manipulated to some extent because the electrons do have some skin sparing. And so to pull the dose to the surface, you have to use various kinds of bolus and so on, tissue-equivalent bolus, whereas for SRT, 100% of dose is deposited at the surface.

And our rule of thumb is to calculate. So you've got about a 50% of the dose at the depth of the lesion, and that maximizes dose to the surface of the lesion and minimizes dose to structures deeper than the lesion. Doses, of course, will depend on lesion size, histology, and patient characteristics.

It has been shown actually that the biological effectiveness of electrons is probably 10% less than that of the superficial X-rays. So relatively speaking, we can lower the total dose that gives control with electrons when we use our superficial unit, and that does come into the calculations.

So low energy photons, we've got very sharp penumbra, which is basically how far out the X-rays will radiate because we've essentially got cones that limit the dose directly onto the tumour, and these cones touch right onto the tumour. Usually, there are small lesions, which is much easier to treat. I've got a cone that goes down to one centimeter, which you have to treat probably the smaller size on a linear accelerator is probably a four-by-four field.

So the smaller lesions benefit here, much less complicated to use, very easy setup. Disadvantages, obviously, limited penetration of the beam depending on what type of orthovoltage you're using. And orthovoltage does give us a higher dose to bone which, in some cases, can be two to four times what goes into the tumour because here, we're dealing with photoelectric effect versus Compton effect of the interaction of the X-rays with tissue. Compton effect gives you the skin-sparing effect of the linear accelerators.



So here, we can see the skin-sparing effect at different energies. You can see up at the top there, it says 300 kV. And to the left of that, it shows three-millimeter copper filter that gives that 300 kV. And you can see that the top of that graph starts at 100%.

So our percentage depth dose of 100% is at zero depth in the water phantom. If we go all the way out to 25 megavolt electrons, which is the top graph, if you look at the hump of that graph at a 100%, that's almost at four- to five-centimeter depth. So those things have to be taken into account when you are treating to the surface.

A couple of other anti-inflammatory type treatment for discoid lupus and this meibomian gland tumours, very easy to treat with this unit. We can put shields in the eyes to protect the cornea, and treat that directly. Those lesions just essentially regress by programmed cell death. And so, there's not a lot of damage to that eyelid.

Talking about benign disease, which I mentioned, is something we do treat. As with malignant growth, there is the ability of radiation therapy to inhibit cell growth and inflammation where there's release of proliferation-stimulating cytokines.

With arthritis, there have been experiments on rodents and dogs, where they have shown that they've responded well to low anti-inflammatory doses of radiation therapy. We get reduced expression of inflammatory cytokines, increased apoptosis of the monocytes that are involved in producing those inflammatory cytokines and so get a benefit.

I used it quite a bit with some cases. I actually had my orthopedic surgeons referred to me with a linear accelerator obviously for deeper lesions, and I treated some hip arthritis, some lumbosacral disease. We probably could treat digits with the SRT.

So with SRT, I mean with modern techniques that we use, the planning that we use, we're using smaller fields, lower doses, risk of late effects, which are the truly damaging effects to normal tissue, which we typically try to set at less than 5%, and the possibility of secondary tumours in bone, for example, are very low. And especially in older age group that might have other comorbidities and could pass on from the comorbidities while being still under control with their tumours.

So risk is definitely less and balanced against the risks of alternative treatments like nonsteroidal anti-inflammatory treatment which can cause all sorts of gastrointestinal problems for localized therapy, this may offer an alternative.

Great for lick granulomas, as we said, it deadens nerve endings and you can hear stop the lick-itch-lick cycle, also reducing inflammation and allowing those lesions to resolve. Very superficial mammary tumours can be treated. Some of the adenomas, obviously, deeper stuff either need surgery and/or the stronger radiation therapy.

So looking at some of the protocols, our standard definitive curative intent protocols, there's 3 Gray fractions, 15 fractions on a Monday, Wednesday, Friday. Our palliative intent protocol or hypofractionated radiation, where it's not particularly used for palliation, it's also called course fractionation.

The standard protocol that we're using trying to establish some caseload is 8 Gray times four where we treat once a week. Obviously, we can have variations on these standard protocols, and as indicated by the disease and/or site. And based on time dose fractionation tables, we can work out lower doses per fraction with more fractions if we're over an area that we have to be very careful about normal tissue, much the same as planning would be done with a linear accelerator.

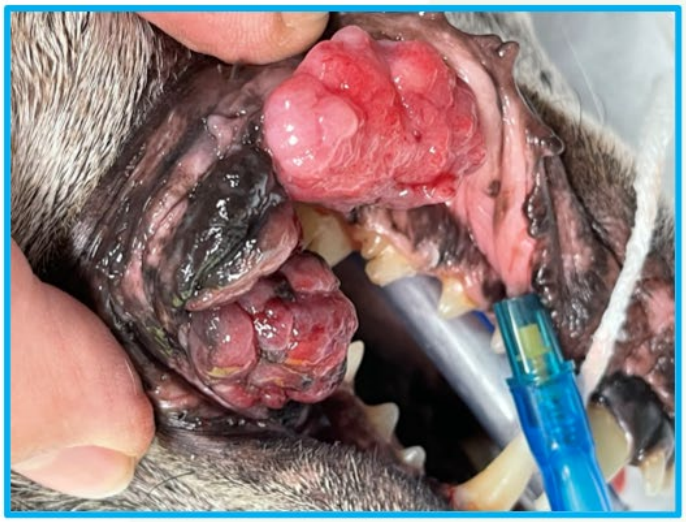
With degenerative inflammatory diseases, much lower dose, and we might do five to 10 treatments. Again, it depends on what we're treating and how significant the disease problem is. This is something that could be repeated three to six weeks later, because it's such a low dose and very unlikely to cause any normal tissue damage.

Hypertrophic and hyper-proliferative lesions, slightly higher dose also spread out over time. Also, possibility of second treatments, and there's some functional diseases even like hypothyroid cats. If there's a large invasive carcinoma that's difficult to remove surgically we can actually treat them with this unit and get control of the hypothyroidism.

With respect to palliative radiation, this is about control of symptoms, again with localized tumours that cannot optimally be treated by other methods.

These symptoms, obviously pain, bleeding, for example, and decreased function. Radiation is commonly combined with, of course, anti-inflammatory medication and pain relief to maximize the benefit for the patient.

Oral Melanoma
Intermediate Grade
Satellite Lesions Post-SRT



Bleeding & Functional Issue
1x12Gy; 100KV

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So here is a classic case that we just actually treated this week. The red lesion was the initial melanoma that we treated in this patient with four fractions of 8 Gray. It regressed initially and then started coming back, but you can still see it's very pink because we sort of knocked out blood flow to this tumour.

Then down below, you can see two new proliferative lesions, which are sort of satellite lesions right next to this one that have come up over the last couple of months literally from the previous treatment. Now, the dog is biting onto these tumours and bleeding.

Otherwise, the patient is just fine, is actually on the melanoma vaccine. So no evidence of metastasis as yet. So still about local control. So what we did, this patient came in for an X-ray, and we decided to do the radiation on the spot. So I did one fraction of 12 Gray.

It's a very high dose, so we got to be very careful what we treat with that with 100 kV, which is going to give us at least a centimeter depth. So I essentially placed all these tumours into the inside of a cone, and you're actually able to manipulate the dose based on the fact that there's tumour inside the cone. You can also adjust if the tumour is outside of the cone and not just at the same level.

And so, I was off all other structures. We moved all the lips out of the way. And under this tumour here against the teeth, I put a lead shield, just needs to be a couple of millimeters thick which would block any dose going further beyond the tumour.

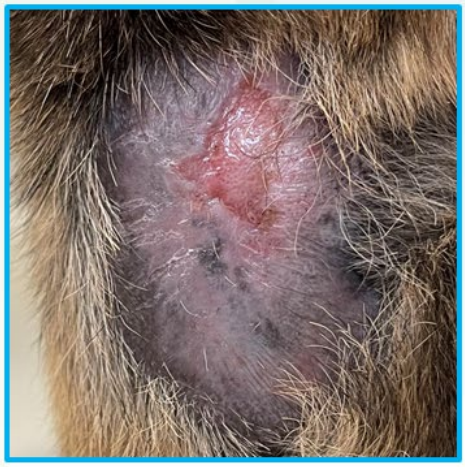
So we'll have to see what happens with this over the next week or two. But I was able to do that planning and treat the patient all on the same day that I saw it. It would be very difficult to do that with a linear accelerator, especially if you're doing a CT scan to do planning and then computer planning which can take sometimes even days.

This was an interesting study that came out quite a while ago, about 10 years, quite a bit of orthovoltage radiation's been done for animals in Sweden. And so they decided to ask their clients what they thought about the experience with the radiation for their pets.

This is probably not a superficial unit but it would be another orthovoltage unit and essentially they felt that it was a worthwhile modality that any discomfort that their pet might have had was very manageable and acceptable relative to the benefits they gained. So that's always nice to see.

So I think we have some time still to look at some patients that we've treated. We'll run through this. This is in our CT room. You can see Danny, my nurse, and myself with one of our patients and the unit to the left.

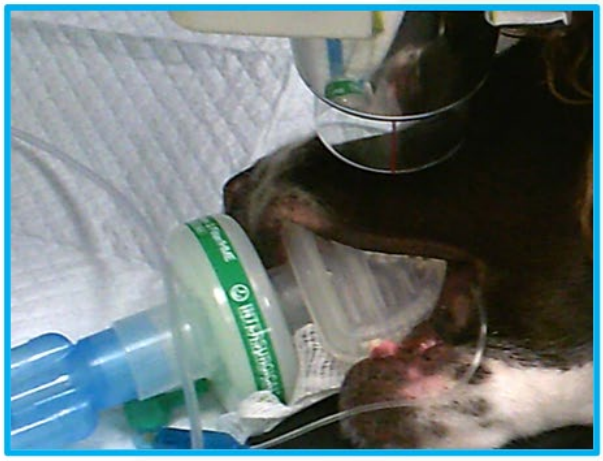
Adjuvant definitive SRT for marginally excised soft tissue sarcoma
15x3Gy; 50KV; 6cm cone plus bolus; MWF



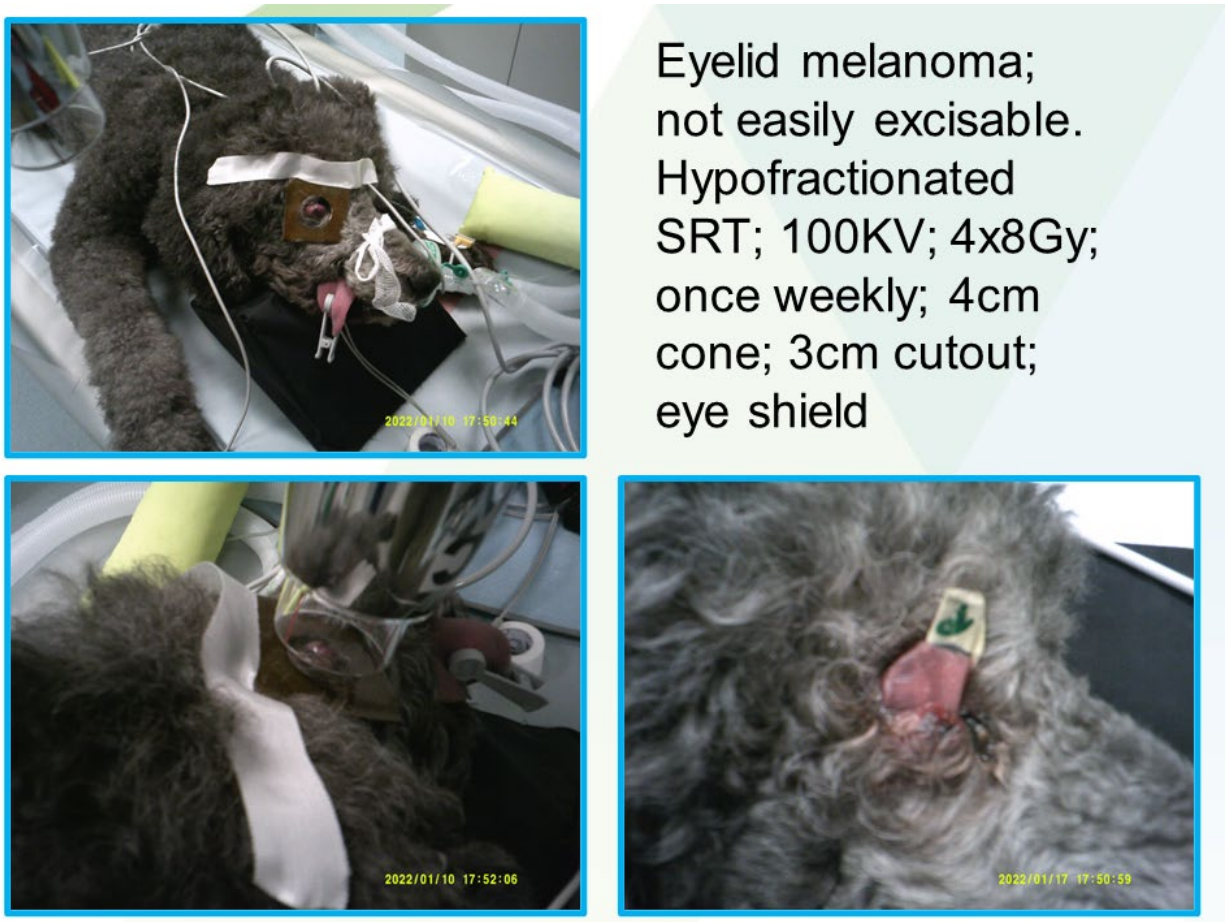
So, this was a soft tissue sarcoma. It was excised of the lateral aspect of the stifle. These people did not want to go to any of the universities so they wanted us to do the postoperative radiation, definitive, curative intent. So 15 by 3 gray, we used 50 kV. We didn't want to get too much depth penetration because there's bone right underneath that. There was a six-centimeter cone and we did use tissue bolus which essentially is gauze-impregnated with Vaseline to pull the dose up a little bit from the bone so that we calculated that the bone underneath would not get too high a dose.

The one picture there shows a little bit of residual radiation reaction. This was, I think, two weeks after radiation was completed. So you can see some changes in the hair, certainly loss of hair, some hyperpigmentation and a little erosion which was still healing. That area was a little larger before, but we gave calendula ointment, which we found very useful, and that's resolving fine, and the pet leaves it alone. They don't lick at it.

Hypofractionated SRT for mast cell tumour not easily excisable
4x8Gy; once weekly; 100KV;
4cm cone; 3mm tissue bolus

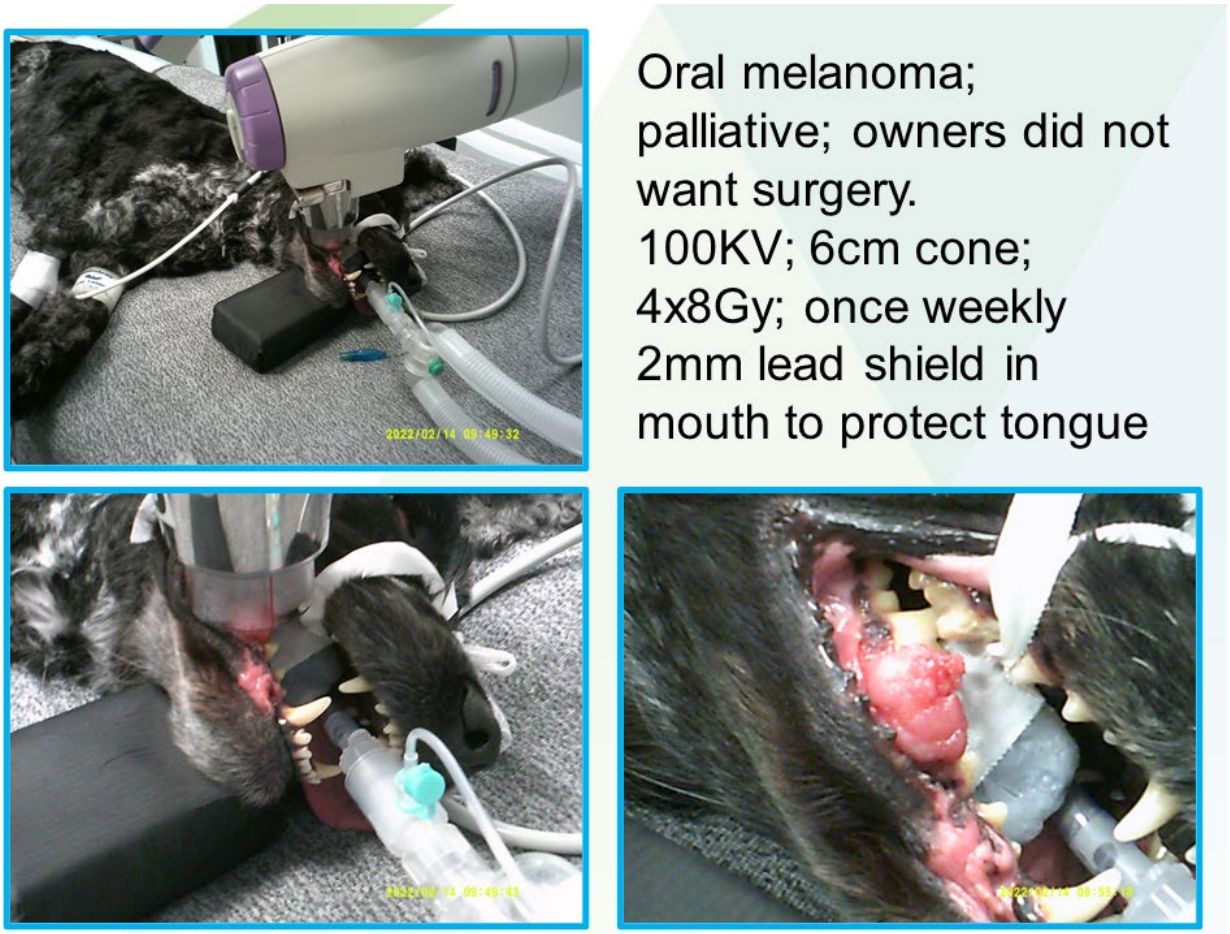


Here was another one. This was the mast cell tumour right down on the edge of the upper lip. And so, we did a course fractionation protocol here. It was a pretty thick lesion into the lip, so we had to use 100 kV, but I was able to again to put a shield underneath that against the teeth, and we used four-cm cone to cover the area and again some tissue bolus to pull the dose up a little bit.



This was an interesting case, eyelid melanoma, lower eyelid. Hopefully, you can see that there is a cutout over that eye, little square cutout. That's a three-cm cutout, and we use then a four-cm cone over the top of that. So that enables us to essentially block a lot of the eye and eyelids around there and just essentially have the tumour sticking out. The program allows you to put cutout calculations in. And so, my physicist just calculated the factor that I had to use in the calculations, and we were able to treat this. The other picture there does show that we put a little shield inside the eye under the mass to shield the cornea.

This was a palliative attempt intra-nasal adenocarcinoma in a very healthy cat. You can see the swelling over the nose that had broken through the nasal bone, was bothering the eye. The eye was starting to be almost shut completely. So the owners asked us to do some palliative. You can see how I angled the beam to try to get through the hole in the bone, and I was able to use a small cone and stay away from everything else. And again, we did put a shield in that eye. That swelling completely resolved, and we are waiting to see if anything comes back. We're using anti-angiogenesis protocol to try to slow down recurrence.

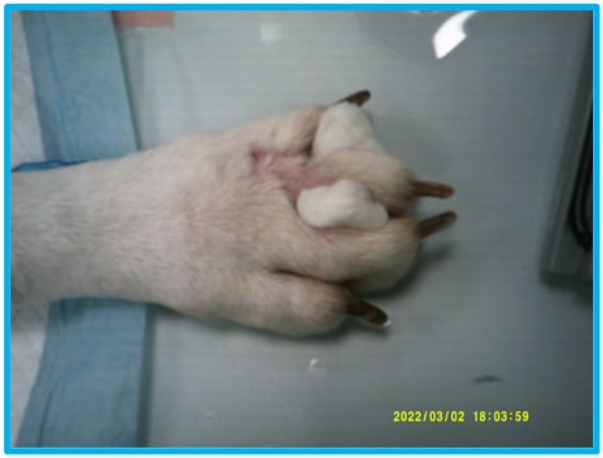


Another oral melanoma. This was more of trying to really knock this tumour back. That had regrown after surgery. Owners did not want to do a jaw excision so they asked us to treat it. And that picture, you see, I think we had done two or three of the treatments. It was very red and proliferative before and bleeding.

And now, you can see it's pink, and it regressed probably by then, probably 40% to 50%. Here was another adjuvant hypofractionated here for a mast cell tumour. There's a very sort of hefty dog. They did not want to amputate toes to get a wide excision. So they asked us to radiate. I used cotton wool in water just to separate the toes, try to keep the other digits and nails out of the way, and then we treated again with bolus, but we did the short course, and we will get some benefit.

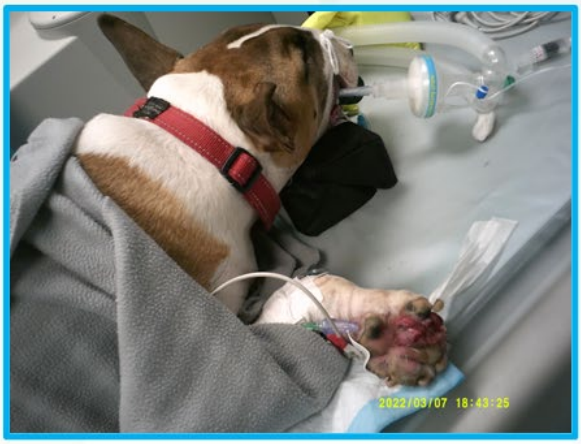
Many studies have shown that with low-grade soft tissue sarcomas using some radiation is better than nothing. So we don't have to do aggressive surgical protocols. We take out as much as we can. And then we're taking essentially a 50% control rate at one year with surgery alone up to 75% for two to three years, even with the short course.

Adjuvant hypofractionated SRT for incompletely excised mast cell tumour; 4x8Gy; 50KV; once weekly; wet cotton-wool between digits; 2mm tissue bolus



This was a very ugly tumour. Histiocytic sarcoma graying on this dog's foot. They initially thought that it was a plasma cytoma, could not really get a diagnosis more than a round cell tumour. And it came to us. It already had a big superficial cervical node, and we were able to make a cytologic diagnosis of histiocytic sarcoma on aspirate from that node.

Histiocytic sarcoma with regional nodal metastasis. Palliative SRT for pain and bleeding.
4x8Gy; 100KV; 4cm cone; once weekly PLUS lomustine chemo
Initial bilateral field; dorsal and palmar; 8Gy both fields.
50% tumour reduction – field changed to single palmar field



Now, this tumour was pretty big, was bleeding. So the owners wanted some palliative treatment there even though we had started lomustine chemotherapy. By the time we saw the pet the second time, the node had completely gone away, which clearly must have been the lomustine.

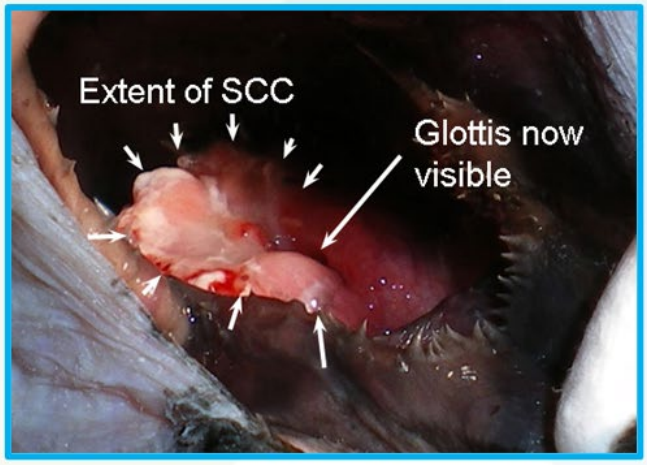
And in order to do the planning the first time, I actually had to treat a bilateral treatment, bilateral opposed. We are treated from the top and the bottom. And again, the program allows you to do a bilateral opposed, but I was treating with the full 8 Gray, both top and bottom.

Again, I made sure I was right over the tumour and not giving any area a double dose of radiation. By the time it came back, which is a lower picture on the left, most of the tumour on the top had died off, and it was much thinner. You can see what it looks like. So I was able to rotate the foot up and then just use 8 Gray at 100 kV directly from the palmer surface. And hopefully, we will continue to see regression between the radiation and the chemotherapy. Dog was much more comfortable even after the first treatment.

“Jiminy” 32yr. Scarlet Macaw

Squamous Cell Carcinoma of the rima glottis

Palliative coarse fractionation(3x8Gy) superficial x-rays (100Kv) per-os



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Just thought I'd just throw in a little bit here on the exotics. This is a squamous cell carcinoma in the rima glottis, and we did a palliative course of radiation. This was in the states three by 8 Gray, 100 kV. And we went in through the mouth essentially.

This is how we set up the bird, and we were able to, with a very small cone, get into position and treat that. I think we were able to control the tumour for about six months, 32-year-old, really, really nice bird.

So these are tumours that are considerations. The ones in red are ones that I have treated in the past. It is quite a list. So there are a lot of things that we can do. A lot of these humans would not do. Mostly, they do nonmelanoma skin cancer. So basal cell and squamous cell are probably the most common that they treat in humans. But there's lots of other things that we can do.

We have to be able to do that at Paragon. So thank you for listening. I really want to thank Xstrahl for putting on this webinar and enabling me to get out some of this information to you people out there or something else to offer your clients for their pets when full radiation protocols are not available. We usually have been sending to Liverpool, but Liverpool is not running their radiation program right now. So essentially, we've only got Southfields, Cambridge, Glasgow, and Edinburgh. So we are in the middle of all of that and we are available to help in whatever way we can. Thank you very much, and I'll take any questions now.

Kristie Amobi:

Thank you, Dr. Ayl. I had a question just to get the ball rolling. How well do the animals generally tolerate the treatment?

Dr. Rodney Ayl:

So they generally do handle it very well. The owners don't tend to see much in the way of trouble with the repeated anesthesias. Even when we are doing it three times a week, they're very light anesthesias,

very short-acting. And we usually use a reversible agent. So sometimes, they seem a little quiet on the day they go home. But then, they're fine after that.

So they seem to handle fine. They continue eating well all the way through. As far as the treatment itself, we really don't see much in the way of side effects at all in the early phases of the treatment. As we get further along, especially in the definitive protocols where you are trying to maximize the dose to the tumour, you can start getting the cutaneous effects.

And so, the pets will want to look at the area. So we usually have to do something to distract them from that using the calendula. Sometimes, they do have to wear a cone for a while. Sometimes just long sleeve t-shirts to keep things open. We don't like to wrap those things up. They tend to get infected if you do that. But we think, sometimes, it's more of an irritant or even feels weird because it might be numb that they lick at it. That don't seem to be horribly painful from it. So if it gets infected, of course, it would increase the discomfort. So generally, I think they handle radiation, in general, very well.

Kristie Amobi:

Okay. Thank you. You mentioned that the limited penetration is one of the disadvantages of a superficial system. Why did you install a superficial system and not a higher energy orthovoltage system such as 300 kV? And what would you recommend for clinics who do not have access to linac?

Dr. Rodney Ayl:

So certainly, as you get up to the higher energies, the orthovoltage units start from about 150 kV and probably would go up to about 450, 500. And the higher the energy is available, the deeper you can go. But you still have the increased potential for the effects on normal tissues just because it is still orthovoltage as opposed to the megavoltage.

And orthovoltage is going to have the problem with any deep bone penetration. So with our small animals, it's not often very helpful to be able to get deeper areas. I looked into the orthovoltage units even when I was in the states. And in terms of where there's an overlap between what we can do on a superficial unit or what we can do on a linear accelerator, anything that's beyond relatively superficial stuff, maybe up to the hundred 50 kV unit, those patients are going to be better served by using the linear accelerators.

But as you say, where linear accelerators are not available, then certainly installing one of the orthovoltage units is much, much cheaper, easier to use, all the reasons I talked about. And it may be better than nothing. But here where we have availability of the linear accelerators, I didn't feel I needed to go any higher and probably, the biggest thing was the cost because here, I could put it directly into room that was already shielded. If you don't have that, you have to get a shielded room and so on that adds to the whole picture.

Kristie Amobi:

Sure. Makes sense. Okay, next question. How do you define margins?

Dr. Rodney Ayl:

Yes. Ongoing question, generally, margins are determined by the surgeon who's removing the tumours and then by the pathologist. There is a difference between surgical margin which the surgeons remove and the margin that a pathologist sees after the sample has been in formalin, because it will shrink the sample by some would say 30% to 50%. So you have to sort of take that into account.

So depending on the tumour type and its grade, which will determine the extent of invasion into peripheral tissue. So for example, mast cell tumours tend not to invade deeply through fascial planes, but they will spread out laterally as you go to higher grade tumours.

So a low-grade tumour, you may only need a five-millimeter margin, whereas with a high-grade tumour, you might want to have more. With a soft tissue sarcoma, they penetrate in all different directions. And so again, you have to take that into account also based on the staging and on a biopsy.

So it just depends on how the tumours are growing. Are they very well-defined pedunculated tumours like that adenoma where you really don't need much of a margin or are you trying to palliate or actually trying to go for a definitive curative intent where you want to be sure you get a good margins? That'll determine what sort of setup we use.

Kristie Amobi:

Okay. Thank you. Next question, there are just time for a couple more. Next question, are birds and reptiles more radio resistant, and how do you work out the dose in these species?

Dr. Rodney Ayl:

It's a good question, and not a hell of a lot's been done. Mostly, it's sort of trial and error, to be honest. And generally, we use the same doses and same protocols. We tend not to do definitive ones because we're talking about anesthetizing a bird three times a week.

We probably don't do that. So a lot of the early work was done back in the states by Jane Terrell at UC Davis many years ago, and she sort of continued... She had an orthovoltage unit for many years and treated a lot of exotics. So she produced some information on that, and we generally used that and extrapolated from that.

But we're mostly using palliative types of therapies for animals that are otherwise healthy. So I've treated some rabbits with soft tissue sarcomas on their legs. Rabbits also get thymomas. We've treated thymomas with the linear accelerator. They respond well when surgery is not an option. Actually treated an Indian rhino in the LA zoo that had a squamous cell carcinoma on its horn from where we delivered 50 kV off the surgery, and we pretty much cured that rhino's tumour.

So it's variable. We are mostly extrapolating from humans to some extent. But there's a lot that's been done over the years in veterinary medicine that enable us to come up with protocols and doses that we work. It's always within safety margins though we'd rather under-treat and retreat rather than over-treat and get late effects that are truly damaging for the pet.

Kristie Amobi:

Okay. Thank you. Final question, I'll just sort of combine these last two. What is your primary referral pathway, and how do you explain the treatment to pet owners?

Dr. Rodney Ayl:

So one of the amazing things that came out of COVID for me is the ability to do remote consults, which I think works very well in oncology. People get a diagnosis of cancer, and they absolutely do not know where to go. And so all my initial consults are remote. I'll certainly speak to vets at any point in time if they have questions.

But then, I do a remote consult with the owner, find out what their goals and expectations are, go over what's involved logistically in terms of the treatment and costs. And then, they decide if they want to proceed. Then, the first time they come here, obviously, we meet them for the first time. But we will be

set up to start the treatment on that day and because of the ease of treatment planning with this unit, I can meet the patient. And literally while my nurses and interns that are inducing for anesthesia, I can do the treatment plan after seeing the tumour and be ready for them to treat. So it all works out pretty smoothly.

Kristie Amobi:

Okay. Thank you so much. One final question that just came in. What sort of dose rates can you achieve? Are you doing in any type of flash radiotherapy with your unit?

Dr. Rodney Ayl:

So the unit has a pretty good size X-ray tube with pretty good output. So the fact that I can do an eight gray fraction or even a 12 Gray fraction within four to five minutes, it is pretty good output. So we, I would say, rarely do a flash kind of things. So I would say that that single 12 Gray fraction was probably the closest to anything like that, but that was for a specific purpose, and it's sort of a one-time thing.

But mostly, we are trying to do right by the patient, and we always are trying to make a patient directed decision rather than disease directed and make sure that whatever we do, we're not going to make the treatment worse than the disease.

Kristie Amobi:

Okay. Thank you. That concludes today's Q&A, Dr. Ayl. I would like to, on behalf of Xstrahl, thank you again for this informative presentation. Just a reminder to the attendees that you will receive link to the recording of this event, which you can also review later on our website as well. Thank you again for your time and attention today. And with that, I will conclude this session. Thank you so much.

Dr. Rodney Ayl:

Thank you.