

Chest wall pain, costochondritis, Tietze's Syndrome, 'slipping ribs,' precordial catch syndromes and xiphoid process pain for GPs (family physicians), Emergency Department (A&E) doctors and cardiologists.



Chest pain is the second most common complaint seen in Emergency Departments worldwide. This paper is aimed at giving GPs (family physicians), ED doctors and cardiologists a better handle on the non-dire pathologies presenting to them with acute chest pain.

Of course the emphasis should always be on the potentially serious pathologies first, e.g. acute coronary syndromes, pneumothorax, pulmonary embolism, myocarditis, pericarditis, dissecting aortic aneurysm, cancers, fractures, etc. However, statistically these make up less than half (and maybe only a third) of chest pain presentations, leaving the majority still to be seen and made sense of, daily.

The most common clinical entity of this non-dire group is best called 'chest wall pain'. Essentially, it is hypomobility (and usually complete immobility) at some of the posterior rib cage joints (costovertebral and costotransverse articulations) and usually also at their associated thoracic facet joints.

This immobility around the back drives compensatory hypermobility strain and pain at the sternocostal joints and/or (less commonly) the costochondral junctions (in which case it is called 'Slipping Rib Syndrome') of the same ribs.

The old 'bucket handle' model of rib movement during breathing applies - when the rib joints round the back can't move, then the ones on the sternum (and less commonly, at the CCJs) MUST move excessively to compensate, with every breath taken. So they strain, 'give' (often with clicking and popping, and often with sharp, stabbing pain), get irritated, locally inflamed, and painful.

This core clinical entity with pain at the sternocostal joints is commonly called '**costochondritis**' worldwide. The term started to be used for the condition in the 1960s, for no reason whatsoever recorded in the literature or justified by the research, and rapidly became the default name for the problem.

Unfortunately the '-itis' ending means 'inflammation', which sends busy doctors down a treatment path to combat it which misses the point and usually doesn't work. There is no significant difference in ESRs between a group with costochondritis and a control group without it (Disla et al (1994) 'Costo ... in an ED setting.'). Costochondritis is not a systemic or autoimmune inflammation.

The problem is usually called **Tietze's Syndrome** if there is also observable localised swelling at the sternocostal joints. Dr Tietze's 1921 paper in *Berlin kin. Wchnschr.* (in German) reports on four patients showing this and asks if anyone has any ideas. Tietze's Syndrome may be understood as simply costochondritis with enough localised

inflammatory response at the straining sternocostal joints to show oedema, just like an acute sprained ankle. It is not a whole different clinical entity.

Brief flicks or short periods of pain from the same mechanism are called **Precordial Catch Syndrome (Texador's Twinge)**.

Xiphoid process pain usually happens because of general lower rib cage hypomobility in conjunction with tight or scarred rectus abdominis muscles and fascia.

The existing peer-reviewed medical research (as at 2019) is clear that:

- (1) Costochondritis is NOT a "mysterious inflammation."
- (2) The best way to fix it is to free up the tight rib cage machinery around the back which drives the strain at the front.
- (3) Statistically, most of it does NOT "just settle down soon."

These understandings are supported in the research but have not flowed through to the popular medical view of costochondritis outside New Zealand. There has never been (as of 2019) any clinical trial to test whether NSAIDs or steroid shots into the sternocostal joints help with costochondritis.

I have put up a YouTube video with a first cut of the research overview for a requested paper for the BMJ: 'Costochondritis and Tietze's Syndrome: The published medical research on how to fix them.' <https://www.youtube.com/watch?v=t8k2LCLeR24&t=10s>
The associated text contains the references - link is <https://www.bodystance.co.nz/assets/Uploads/Costochondritis-and-Tietzes-Syndrome-published-medical-research.pdf>

Inside New Zealand manual physiotherapy the problem is seen as a simple hyper/hypo joint couple, readily fixable by freeing up the tight rib cage machinery around the back, which allows the ongoing compensatory straining of the rib joints on the sternum to settle down. It's generally easier to sort out than the average low back or neck problem. It is essentially a specific mechanical problem, not an inflammatory one amenable to an anti-inflammatory medication and/or steroid injection approach.

This paper aims to present the standard history, signs, symptoms and clinical tests for this common ED and cardiologists' problem, making logical sense of its various presentations in the light of its underlying core mechanism.

This is probability diagnosis, as is much of medicine. There is no single clinically diagnostic test to definitively rule in costochondritis or the other chest wall pain pathologies. The hypomobility of the thoracic and posterior rib joints will not show on X-ray, MRI or CAT scans, as these are all essentially still photos, and cannot show whether the joints can move fully and freely, or are completely frozen. But there is a distinctive collection of signs and symptoms, history and a few clinical tests that will strongly indicate the clinical entity.

A word of caution - nothing says your patient can't demonstrably and conclusively have frozen rib machinery causing costochondritis AND also be having a heart attack.

(A) Patient signs and symptoms indicating costochondritis from hypomobile or immobile posterior rib joints.

(1) Clicking and popping, which may be with sharp stabbing pain, at the sternocostal joints. These are mechanical symptoms, not inflammatory ones. They happen because of the rib joints on the sternum 'giving' under load, like cracking your knuckles or spraining an ankle. They have to move excessively with every breath taken because the rib joints (costovertebral and costotransverse) at the other ends of the same ribs where they hinge onto the spine are immobile.

(2) Localised oedema at some sternocostal joints. This is not a manifestation of a systemic or auto-immune inflammation, but simply localised inflammatory response from the mechanical strain and sprain at the sternocostal joints, exactly the same as oedema with a sprained ankle. Unlike an ankle sprain, these sternocostal joints never get a rest as long as the posterior rib joints cannot move - they will continue to strain with every breath taken.

When there is enough localised swelling to be observable, the problem is usually called Tietze's Syndrome. This is not a completely different entity, but just costochondritis with enough localised oedema to be noticeable.

(3) Pain also around the back at some of the hypomobile "locked" posterior rib joints. This is a duller pain, and often not volunteered as the patient focuses on the sharper, scarier pain round the front. (I think the predominance of left-sided pain in costochondritis statistics is an artefact. Anecdotally, patients will put up with pain on the right side, because they think it can't be the heart; whereas if it's left-sided then they'll come to the ED or their doctor. The pain can also be right-sided or bilateral.)

(4) Difficulty in breathing in fully; breathlessness, even though the heart and lungs check out fine. This is because full inspiration requires full rib cage expansion, and the patient can't do that if some of the rib machinery round the back can't move. This cause of breathing difficulties does tend to get overlooked.

Note that X-ray, CAT and MRI scans are all essentially still photos, so cannot show whether the rib or spinal facet joints can move fully or are frozen solid. (That's why you need to do the two clinical posterior rib joint movement tests.)

(5) Pain on lying down or sleeping. Sleeping in any position (except sitting up) involves lying on the rib cage. If the rib joints around the back can't move, then the strain goes onto the already strained rib joints on the sternum. So they hurt more, usually after only a few hours.

(6) Anxiety. Of course this is present because the patient thinks they might be having a heart attack. But even after reassurance that tests show the heart, lungs, etc. are fine, you get anxiety with costochondritis at levels you just do not see with a neck or low back problem, say.

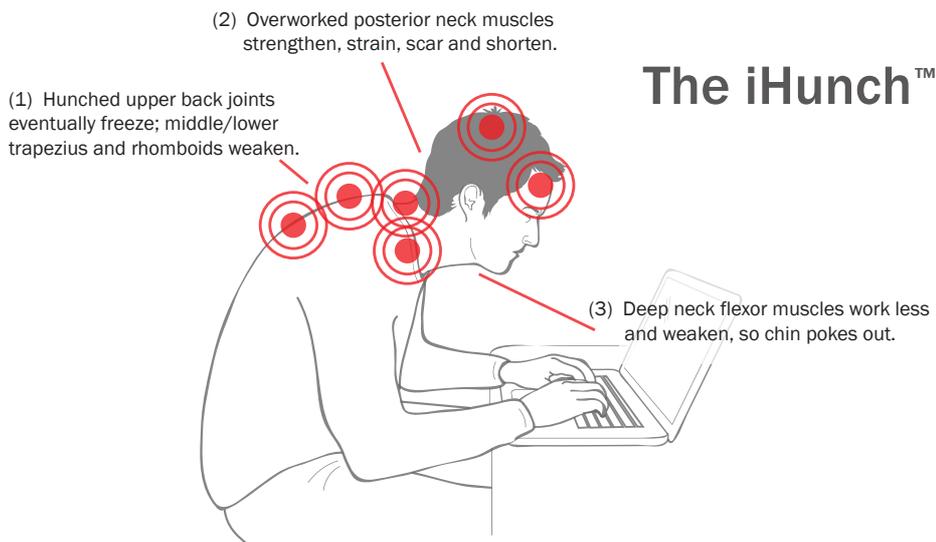
I think the extra driver is that, because some of the posterior rib joints cannot move, the patient cannot breathe in fully, because they cannot expand their rib cage fully. So they breathe high and fast, and this hyperventilation pushes them towards panic attacks, and certainly anxiety.

Further, if the doctor has reassured the patient that their chest pain will settle down soon, and it doesn't (and statistically most of it will last longer than a year (see the Disla et al paper)), then the patient thinks if the doctor got that bit wrong, then maybe they're also wrong about it not being the heart.

The best approach is to reassure the patient that the tests have shown it's not the heart or anything else dire, and that it will EITHER settle down soon OR is readily fixable with correct treatment.

(B) Past histories indicating mechanical strain or impact on all or part of the rib cage.

(1) The iHunch. See the iHunch page on the Backpod's website <http://backpod.co.nz/en/ihunch> The iHunch is the tsunami of hunching thoracic spines now driving most neck pain and headache in the developed, computer-savvy world. This is probably now the biggest single driver of new costochondritis. As the excessive thoracic kyphosis freezes and becomes fixed, so too do the posterior rib joints, and this in turn makes the sternocostal joints strain to compensate with excessive movement.



(2)+(3) = Every facet joint in the neck compressed, hence eventually acute locking, pain, headache, IV foraminal nerve exits closed down so referred pain down arm(s).

(2) Direct impact on the rib cage. This includes falls and blows, common in sports such as rugby, skiing, judo and other martial arts, surfing and horse-riding. Also **MVAs** with the chest hitting the steering wheel, its airbag, or seat belt. Also life-saving **CPR**, which obviously has the highest possible priority at the time, but can leave a legacy of ongoing anterior chest pain which is usually interpreted by the patient as their heart.

Front impact trauma will settle as expected. When the sternocostal joint pain persists much longer than that, it's because the posterior rib and thoracic joints were also jolted sufficiently by the initial front impact to sprain, scar (adhesive fibrosis) and freeze into immobility. This then sets off the compensatory strain and hypermobility at the sternocostal joints.

Much coughing delivers a surprisingly strong percussive impact to all the rib cage joints. If the rib cage is already sufficiently tight around the back before coughing starts, then only the more delicate sternocostal joints can 'give' (and strain) to take the shock. There are indications of a tsunami of fresh costo outside NZ after coughing with **COVID-19**.

(3) Strain, especially on an already tight rib cage, including lifting/pulling/straining. Dips trigger way more costo than any other exercise in the gym; bench pressing is second. Golf is a common trigger - driving a golfball uses maximal torso rotation. If the posterior rib joints are restricted, the ballistic strain goes to the more delicate sternocostal joints.

(4) Pregnancy with a tight rib cage. As the baby bulge increases, the tight rib joints round the back stay tight (Relaxin doesn't seem to loosen adhesive fibrotic scarring and tethering), so the more delicate sternocostal joints effectively get forced apart; certainly strained. The costochondritis pain can often continue even after the baby arrives, in fact until the frozen posterior rib joints are freed up.

(5) After thoracotomy operations, especially sternal splits. These all have an appallingly high rate of ongoing pain afterwards, usually over 70% at a year past the surgery. Cranking the ribs or sternum apart to do any sort of thoracotomy op puts a MASSIVE strain on the posterior rib joints. Unsurprisingly, they'll usually tighten and freeze afterwards, as part of normal adhesive fibrotic scarring repair; they respond really well to stretching free again with a Backpod. Also, the scarring repair (especially after a sternal split) leaves the free nerve endings locally hypersensitive - which responds really well to simple massage.

(6) Ankylosing Spondylitis. As with the iHunch, the tightening thoracic kyphosis includes stiffening at the posterior rib articulations. When these are tight enough, the compensatory excessive movement and strain occurs at the sternocostal joints.

(7) Chronic asthma. It's not solely about the lungs - the rib cage itself tends to become tight, especially after childhood asthma when the patient has often grown and developed while hunching over to suck in air. This rib cage expansion restriction is frequently not considered as a contributing reason for breathlessness, though it is very common.

(8) Scoliosis. The posterior rib joints down one side of the rib cage are already under extra load, just because of the twist in the thoracic spine. So scoliosis is a predisposition to costochondritis, especially as the kyphotic component contributes, e.g. from the iHunch.

This may be quite common after fusion surgery for scoliosis, and treatable by freeing up the posterior rib joints in the usual way, as these have not themselves been actually fused.

(9) Chest binding, as used in female to male transition, aesthetics, cosplay, etc. A non-elastic circumferential undergarment is worn, intended to suppress the breasts. However the whole rib cage is restricted, including the joints at both ends of the ribs. Yet expansion of the rib cage is required for breathing.

Something has to give, and it is usually the much more structurally delicate sternocostal joints. The more structurally robust posterior rib joints tend to stiffen and freeze due to the restrictive effect of the binding. The compensatory straining of the sternocostal joints forms the other half of the hyper/hypomobile rib joint combination which is the mechanism causing costochondritis.

(C) Clinical tests for hypomobile or immobile posterior rib articulations.

Note that X-rays, MRI and CAT scans are essentially still photos, so cannot show whether spinal and rib joints can move freely or are frozen solid. So these clinical tests are necessary. They are good indicators but not perfect ones.

(1) Sitting torso twist test for rib and/or thoracic joint hypomobility:

Sit the patient back squarely on a plinth or examination couch. Take time to do this properly - they should not be teetering on the edge. Wriggle them them right back so their knees are pressing against the edge. Knees apart so they've got a locked, stable pelvis, so that when you do the torso twist it is accurately torso rotation that you're testing.

Grasp their shoulders and rotate their torso, in both directions. Normal range would be 90°, with their shoulders coming into line with their thighs (if their knees were together, i.e. in the sagittal plane). If they're obviously restricted and painful when twisted towards the side their costo is painful on, then that means some of the rib (and probably also thoracic spinal) joints round the back are frozen and not moving. (This can often be in-your-face obvious, e.g. getting only 45° towards the painful side, but 85° turning away from it.)

These same immobile rib joints will be causing the costo strain and pain round the front. We call it a hyper/hypo couple - when the rib joints round the back can't move, then the ones on the sternum HAVE to move excessively, just to allow breathing and torso movement. So these strain, 'give' (often with cracking and popping, with or without sharp stabbing pain), get irritated, get locally inflamed - and it's then called costochondritis. If there is enough swelling to be observable, then it's called Tietze's Syndrome.

Note that patients who are naturally very flexible can still have specific hypomobility in some rib joints, which is masked by their excellent or excessive mobility in the others. So if this test shows an observable restriction, this definitely indicates some joint hypomobility; however even with no total restriction showing, they can still have some specific rib or spinal joints that are completely immobile.

(2) Prone lying bounce test for the posterior rib joints:

You can get people who are so naturally flexible (general joint hypermobility, EDS, etc.) that they can still twist round to 90°, even though some of their rib joints are immobile, i.e.

their general hypermobility masks the specific rib joint hypomobility which is causing the specific sternocostal joint strain at the other ends of the same ribs. You can identify these ones by just lying them prone on an examination couch and bouncing vertically down with your fingers on the curve of each rib, i.e. about 30-50mm out from the midline of the spine.

This isn't difficult. It's MUCH easier than doing baby palpation in pregnant ladies, or soft organ palpation. Articular cartilage is slipperier than an ice skate on ice, so if the joints are moving freely and fully, then all you feel is a springy, rubbery give and rebound as you push down on a specific rib and then release. If the joint is frozen solid, then it feels like you're pushing down onto concrete.

You have to push in through the normal muscle and skin springiness to get down to the ribs, but once you're down onto the bones it's usually quite clear - certainly after a bit of practice. If the costochondritis is unilateral, then you have a freely moving good side to compare with. It doesn't take long to build up a personal 'feel library' of what a freely moving rib joint feels like compared to a completely frozen one.

(3) Supine lying palpation / bounce test for the sternocostal joints:

Lay the patient supine, position your fingers on the distal end of each rib, just back slightly from the joint itself, and bounce vertically downwards. If the sternocostal joints are slightly hypermobile and sprained, this downward joint shear will usually hurt - often a lot, so go in gently.

Pain at the sternocostal joints usually indicates the hypomobile posterior joints/ hypermobile anterior joint strain problem described, but it can still be there without actual pain on surface palpation of the sternocostal joints. This shearing bounce test is a better indicator.

In Tietze's Syndrome there is also observable localised swelling around the sternocostal joints. Tietze's is not a separate entity but just costochondritis with sufficient local inflammatory response to show swelling at the joints, as you'd get from continuing to run on a sprained ankle. The swelling is usually harder at the core, with fresher, more fluid swelling surrounding that.

(4) The 'finger poke' patient indicator:

This is surprisingly accurate, anecdotally. Ask the patient to "Show me what your pain feels like." They'll indicate a heart attack with a clenched fist squeezing action. They'll indicate costochondritis by one or more outstretched fingers poking at where the pain is on their chest.

I can't find published research on this. It's derived from a Glasgow hospital ED looking back over videos of patient presentations with acute chest pain that was later definitively diagnosed. Apparently it was 100% accurate, according to a doctor in one of my lectures who was there. He recalls that n-values were low; maybe only 10 patients. However it's a very quick and simple thing to ask or observe.



(D) Patient response to trial treatment.

This can be very quick and definite. Assume the sitting twist test has shown a clear restriction in the direction of pain, and that this finding is reinforced by clear lack of bounce movement at the posterior rib joints on the prone lying bounce test.

(1) You can use this prone lying bounce test as a trial treatment. The core problem is that some of the posterior rib joints cannot move. Simply spend a minute or two bouncing down on these using your fingers or thumbs on the curve of the ribs involved, starting gently and going harder, feeling the movement start to free up as much as it can with this degree of force. This is usually quite clear and quite quick.

Then re-test the torso twist in sitting. The improvement is often obvious and large.

(2) A stronger technique is a manipulation thrust for the ribs and thoracic spine, with the patient in prone lying. This has some similarity to a CPR thrust, but it's not so hard. Lean over the patient, with your forearms crossed and hands on either side of their spine. Place the heel of one hand over the curve of the tight rib(s), with the finger pointing away from the spine. Place the heel of the other hand just below (caudally inferior to) it, with the fingers pointing the other way, i.e. also pointing away from the patient's spine.

Ask the patient to breathe in fully, then to breathe out. As the patient finishes breathing out, thrust sharply down with your hands, emphasising the thrust with the heel of the hand over the curve of the tight rib(s).

You will often get a dramatic click or crack as the joint surfaces momentarily separate, exactly like cracking one's knuckles. Then re-test the patient's sitting rotation. A clear increase in range and reduction or clearance of pain indicates the posterior rib and spinal machinery has freed somewhat, and that therefore this is likely the core problem. The freeing up of thoracic rotation is often dramatic.

Symptom responses also are often immediate, e.g. full or major clearance of pain at the sternocostal joints, and the ability to take a full breath in. This is immensely reassuring for the patient - a personalised demonstration that the problem is indeed of this sort and therefore should be fixable.

(E) Referral and recommendations for further treatment.

This can be a problem. Worldwide, medically and popularly, costochondritis is usually seen, erroneously, as a ‘mysterious inflammation.’ This means every treatment aimed solely at suppressing an assumed systemic inflammation, or directed solely at the pain round the front, or purely setting out to modify the pain response, misses the point.

Medicine of course has its essential roles - checking out the possible dire pathologies is always the essential top priority. NSAIDs, muscle relaxants, etc. have their place in the acute presentations. If there is a burning quality to the pain in a chronic presentation, then low dose tricyclics will slowly desensitise a fired-up nervous pathway component.

But the modify-the-CNS-and-nerve-impulses approach taken by pain clinics and specialists is usually not effective, because the sternocostal strain is ongoing with every breath taken, as long as the rib joints round the back remain immobile. The pain clinic assumption usual with chronic costo - that there is no longer an organic problem causing the pain, and that therefore the only useful route to help the patient is to modify the pain impulses - is simply wrong in almost all cases.

There have never been any clinical trials to test if NSAIDs or steroid shots into the sternocostal joints are actually useful with costo (as at March 2020). Anecdotally they often are, but only temporarily until the steroid wears off, and only until the NSAIDs have taken the heat out of the localised inflammatory component - leaving the ongoing mechanical strain unaddressed.

At core, costo is a manual physiotherapy problem. However physiotherapy (and its US version Physical Therapy) breaks into sub-groups. The exercise prescription school uses stretching, strengthening and various mobilising exercises to treat various musculoskeletal conditions. This approach on its own does not work with costo, because the already strained sternocostal joints will just strain further, way before you get a benefit to the tight rib and spinal machinery round the back.

To fix costo, you have to accurately free up the specific immobile rib and spinal joints driving the strain at the rib joints on the sternum. Hands-on manual physiotherapy has exactly the techniques and understanding for this. Not all physios and Physical Therapists have these post-grad qualifications and skills. Also, physios vary, as do all health professionals.

Chiropractors vary. The less thoughtful ones will use a body-slam-onto-the-patient-with-the-chiro's-fist-in-their-back manipulation technique that squashes and further strains the already strained sternocostal joints. In any case, in a chronic problem, the improvement doesn't last, as the surrounding shortened collagen of the joint capsules, ligaments and fascia quite rapidly tightens up the freed joints again. (Hence the treatment cliché of patients going back and back to the chiro to get the same hinges repeatedly banged free, indefinitely.)

Although I've been lecturing on costo at various GP conferences in New Zealand over the last few years, this validated manual physio understanding of costo I'm presenting isn't yet widely known to doctors, even in NZ. So for the ED just to send the patient back to their GP is not a guarantee of effective follow-up treatment fixing the problem. And there's a

good chance the ED or cardiologist will see them back again if it's not fixed. So will the GP, until the patient gives up.

Beyond any specific interventions, the most reliable way to help is to also suggest the patient can find more information about costochondritis and how you fix it on the 'Costochondritis' page of the Backpod's website - link is <https://www.bodystance.co.nz/en/costochondritis/> They can just Google 'Backpod' and then go to the 'Costochondritis' page.

Please do see the Disclosure below, but I do not think there is any other resource available, worldwide, with a popular overview of the actual immobile rib joints basis of costo and other chest wall pain. The page includes patient-level explanations with links to YouTube videos and pdfs covering research-supported treatment of costo, an overview of the existing medical research (with references), home tests, and home treatment.

We are working on further YouTube videos and pdfs including costo for EDs and GPs (family physicians); specific treatment techniques for physio, chiro and osteopaths; a step-by-step treatment programme for patients; and searchable FAQs answering the most common questions I've been asked out of over 10,000 queries about costo from all round the world in the last few years. These will all go onto the 'Costochondritis' page as we complete them.

(F) Disclosure - the Backpod.

I have a special interest in costochondritis since a climbing fall in my 20s left me with a patch of my left rib cage around the back scarred and immobile. For the next seven years I got the debilitating sharp stabbing pain at the left sternocostal joints, the inability to breathe in fully, and the fear that it was a heart attack in spite of tests and reassurances. I've been there, and I do sympathise with the patients - it's a scary, nasty problem!

I fixed it after qualifying as a physiotherapist in Otago, New Zealand, using manual physio techniques. I haven't had any pain whatsoever from it for over 30 years and can do anything physical. Of course it's not a mystery and of course it's readily fixable.

I'm also the clinical member of the team that developed the Backpod - a New Zealand spinal fulcrum built primarily to stretch out shortened collagen around hunching thoracic spines. The iHunch is now the biggest upper spinal problem in the computer-savvy world.

Collagen is stronger, by weight, than steel wire. A home fulcrum using the patient's upper body weight is the only practical way to get long enough (one minute plus), strong enough, localised enough leverage to actually stretch out the shortened collagen around chronically hypomobile, hunched thoracic facet joints.

The small peaked shape of the Backpod has the ability to do this for hypomobile posterior rib joints also. Nothing else really does - foam rollers can't localise much force to specific ribs because of their long cylindrical shape; all balls and rollers are unstable so the muscles can't relax, which opposes the collagen stretch; rolled towels and Swiss balls are too squashy to provide the leverage needed. Hands-on manual techniques (including manipulation) can unlock immobile hinges effectively and quickly, but they can't stretch out the surrounding shortened collagen so the joints can stay free.

As such, the Backpod is probably the single best tool in the world for actually fixing costochondritis. I do make a few dollars (literally) off each one sold, but building something effective out of 30 years' expertise in the area does not automatically invalidate that expertise.

So the reason the costochondritis information is on the Backpod's website is that I'm trying to do something about the problem, worldwide. The Backpod gets a valid mention - just as oranges would in a practical discussion on how to cure scurvy.

Everything else on the website including exercises, stretches, home massage, etc. is free for the patients - they can make an informed decision about their problem and whether the Backpod is a worthwhile gamble for it. We now sell 99% of Backpods outside NZ, and the feedback re treatment of costochondritis we've had from all around the world is overwhelmingly positive, as for example the hundreds of 5-star reviews on Amazon.co.uk.

Anyone is welcome to ring or email me anytime to discuss any points raised, and also to discuss specific patients. I've retired from treating patients myself but am usually available to consult or lecture. My email address is bodystance@gmail.com

Best regards,

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(Dunedin, New Zealand; April, 2020.)



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