

EXERCISE ANATOMY / NARRATIVE EVIDENCE REVIEW

Neck exercise anatomy and muscle recruitment

Three exercise patterns and their relationship to physiotherapy and yoga

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Abstract

Conclusion. Related resistance exercises can recruit and train the muscles beneath the jaw. That finding supports a muscular-conditioning rationale, but does not establish that Nexaball changes neck appearance, treats pain or improves sport performance. Rotation and lateral flexion have plausible cervical muscle targets; their exact ball-supported geometries need direct testing.

Purpose and scope

This review examines three Nexaball movement patterns, the muscles most likely to contribute, and the extent to which research on chin-tuck resistance, physiotherapy and yoga can inform their interpretation. It also retains the original question of whether training might influence submental support and contour.

Suprahyoid activation is measured in related chin-tuck-against-resistance studies [1, 2]. Evidence from other devices and populations is indirect for Nexaball. Individual-muscle rankings cannot be read from a photograph or a grouped surface-electromyography signal.

Principal findings

The clearest exercise-specific signal concerns the suprahyoid group. Cervical rotators and lateral flexors contribute according to movement direction and resistance. Related yoga and therapeutic programmes can improve clinical outcomes in selected populations, but do not validate a single ball exercise or a cosmetic claim.

Methods

The source review was expanded through targeted PubMed searches and bibliographic checks on 30 September 2026. Topics included suprahyoid resistance, cervical muscle recruitment, deep-flexor exercise, yoga for neck pain, muscle thickness, hyoid position and skin mechanics. Selected open full texts were consulted; most other records were assessed from abstracts.

This is a narrative synthesis, not a systematic review. Search results were selected for relevance; no exhaustive search, duplicate screening, formal risk-of-bias scoring or pooled analysis was undertaken. The reference list contains sources used in this revised text.

How evidence is labelled

Measured refers to a result from the stated study and protocol. **Anatomical inference** describes an expected contribution based on muscle action.

Unverified transfer means that a result from another exercise, device or population cannot yet be assigned to Nexaball.

01 / THE NECK AND SUBMENTAL REGION

Anatomical foundations

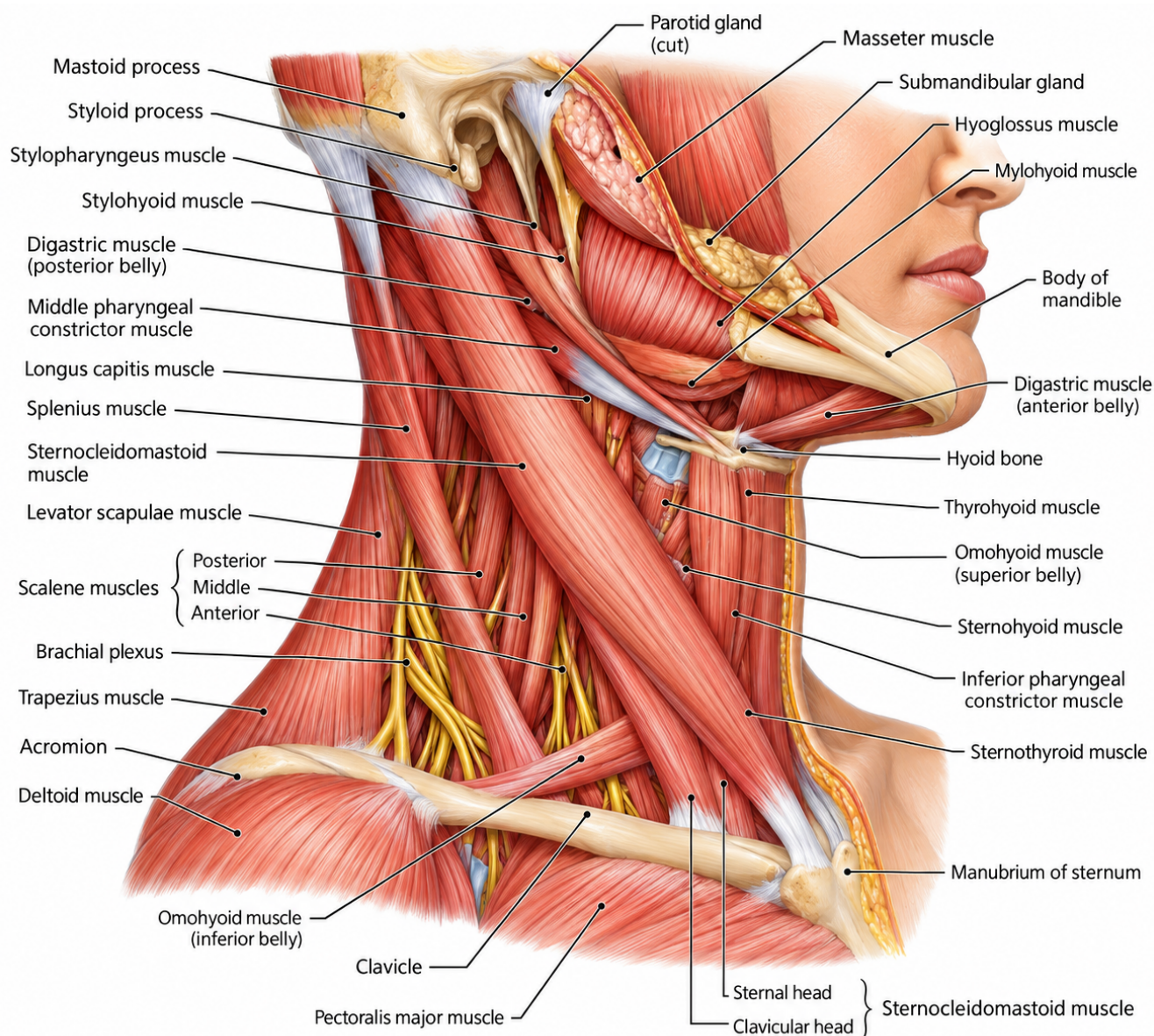


Figure 1. Supplied lateral neck illustration, reproduced without changing its labels. It is an illustrative orientation aid, not an independently verified anatomical plate. Some deeper structures, including geniohyoid and longus colli, are not separately identified. Functional interpretation follows the cited anatomy and exercise literature.

Beneath the jaw

The suprahyoids comprise mylohyoid, geniohyoid, digastric and stylohyoid. Their actions depend on whether the mandible or hyoid is fixed. They can assist hyoid elevation or jaw opening; they are distinct from the main cervical rotators and lateral flexors. [31]

Around the cervical spine

Large superficial muscles and smaller segmental muscles share movement and control. The illustration also shows glands, bones and nerves: their presence does not mean they are exercise targets. A visible muscle is not necessarily the muscle receiving the greatest load. [30]

02 / FUNCTIONAL MUSCLE MAP

Muscles and movement patterns

This map separates expected movement contributors from stabilising or incidental activity. No direct study has ranked every muscle during the three Nexaball positions. The lists are functional, not claims of equal recruitment or proven hypertrophy. [30,31] [12]

Region	Muscles to consider	Relevant role
Submental and hyoid	Mylohyoid; geniohyoid; anterior and posterior digastric; stylohyoid. Infrahyoids: sternohyoid, omohyoid, sternothyroid, thyrohyoid.	Suprahyoids are the best-supported group for related chin compression. Infrahyoids may provide hyoid or laryngeal control; equal activation is not established.
Anterior cervical	Longus colli; longus capitis; rectus capitis anterior; sternocleidomastoid; anterior scalene.	Deep muscles contribute to flexion and control. Larger superficial flexors may contribute as force or movement increases.
Rotation and lateral flexion	Sternocleidomastoid; splenius capitis and cervicis; longissimus capitis and cervicis; semispinalis capitis and cervicis; anterior, middle and posterior scalenes.	Contribution depends on the side, head position and external resistance. Rotation pairs muscles from opposite sides; side bending commonly emphasises same-side contributors.
Upper cervical and segmental	Obliquus capitis inferior and superior; rectus capitis posterior major and minor; rectus capitis lateralis; cervical multifidus, rotatores and intertransversarii.	Potential segmental control and upper-cervical contributions. Exact ball-exercise activation has not been established.
Shoulder and jaw support	Upper trapezius; levator scapulae; masseter; temporalis; pterygoids.	Scapular fixation and mandibular positioning may alter the task. Jaw clenching and shoulder shrugging are not intended training targets.

The meaning of most affected

Activation, force, fatigue, stretch and long-term growth are different outcomes. A muscle with a large mechanical moment arm need not show the highest activation, and a strong electromyographic signal does not guarantee the largest training adaptation.

The exercise pages therefore identify a best-supported group or a likely mechanical emphasis. They do not invent percentages for individual muscles.

Side and fixation matter

Ipsilateral means the same side as the movement; contralateral means the opposite side. Holding the shoulder steady changes the length and action of muscles linking the neck and scapula. Holding the jaw steady changes the role of the hyoid muscles.

The same-looking movement can become an active range-of-motion task, a stretch, or resistance work depending on how force is applied.

03 / EXERCISE ONE

Cervical flexion compression



Figure 2. Chin-on-ball compression. Supplied product photograph; an illustration of placement, not a measurement of muscle activity.

Movement and load

The chin lowers gently onto a ball supported beneath the jaw. Compression adds external resistance; a sustained hold is isometric when head position stays still. Pressure, ball stiffness, jaw position and head movement all affect the load.

Best-supported emphasis

The suprahyoid group is the clearest measured target in related CTAR tasks. Grouped surface EMG cannot establish whether mylohyoid, geniohyoid or one digastric belly is the single most active muscle. [1, 2, 4]

Recruitment tier	Muscles and interpretation
Primary group	Mylohyoid, geniohyoid and digastric are plausible anterior submental contributors. Stylohyoid and posterior digastric belong to the group, but individual ranking is unmeasured.
Cervical contributors	Longus capitis, longus colli, rectus capitis anterior, sternocleidomastoid and anterior scalene may assist head movement or control. Their share changes with technique; isolated deep-flexor training is not demonstrated.
Support and coactivation	Infrahyoids may help stabilise the hyoid. Jaw closers may hold mandibular position; cervical extensors may coactivate. These are not proven equal training targets.

Closest established exercise

Ball-assisted CTAR is the closest published analogue. Relative to head-lift exercise, related studies report more selective suprahyoid recruitment and less sternocleidomastoid activity. [2, 3]

A physiotherapy chin nod also involves flexion, but is generally a low-load deep-flexor motor-control task. It should not be described as mechanically identical to ball compression.

What the evidence permits

The rationale is targeted resistance for the anterior submental region. Nexaball-specific force, muscle activation, training dose and outcomes remain unmeasured.

The activity does not establish fat reduction, skin tightening, improved swallowing or relief of neck pain in a general consumer population. A visible chin tuck alone cannot prove deep-flexor selectivity.

04 / EXERCISE TWO

Cervical rotation and rotated compression



Figure 3. Ball supported at the side of the neck. The leaflet rotation roll and review variation are distinguished below.

Two related but different tasks

Leaflet rotation roll: the ball rests below the jawline; the head turns towards it with gentle pressure. **Review variation:** the head is already turned and the underside of the chin compresses a shoulder-supported ball.

Rotation against resistance loads rotators. Downward compression in a rotated posture may recruit submental muscles while rotators maintain position. The contact point determines which task predominates.

Likely emphasis

For rightward rotation, left sternocleidomastoid and right splenius capitis or cervicis are important expected contributors; leftward rotation reverses the pairing. This is anatomical inference. [30]

Recruitment tier	Muscles and interpretation
Main rotational contributors	Contralateral sternocleidomastoid and ipsilateral splenius capitis/cervicis; ipsilateral longissimus capitis may contribute. The exact balance is not measured for the ball task.
Additional cervical control	Contralateral semispinalis and cervical multifidus/rotatores; ipsilateral obliquus capitis inferior and rectus capitis posterior major may contribute, especially to upper-cervical rotation.
Compression and fixation	If the chin presses down, suprahyoids may contribute; deep flexors help position the neck and shoulder muscles help fixation. No specific suprahyoid ranking follows from the rotated photograph.

Related mobility and therapy

Unloaded seated neck rotation is used in NHS mobility guidance. It explores comfortable motion; resistance is not required. [32,33]

Manual isometric rotation is a closer loading analogy than an unloaded yoga twist. Similar direction does not mean equivalent force or effect.

Limits of multidirectional evidence

A diagonal CTAR trial used a chest-fixed spring device and a supervised six-week protocol. It did not test the shoulder-supported ball variation. [6]

Avoid forced 90-degree rotation or end-range extension. Comfortable placement is essential; the geometry needs product-specific testing.

05 / EXERCISE THREE

Cervical lateral flexion



Figure 4. Lateral ball-supported position. Gentle inclination creates resistance only when the ball meaningfully opposes the movement.

Movement and load

The ball rests between the side of the neck or jaw and the shoulder, supported by the hand. The head gently inclines towards it while the trunk remains upright. Ball position and shoulder fixation influence whether the task is resisted side bending or simply supported motion.

Likely emphasis

Same-side lateral flexors are the expected main contributors. In a laboratory isometric task, ipsilateral sternocleidomastoid was most active among the three recorded muscles, followed by splenius capitis. That limited comparison is not a ranking of every muscle or a Nexaball result. [11]

Recruitment tier	Muscles and interpretation
Main expected contributors	Ipsilateral sternocleidomastoid; anterior, middle and posterior scalenes; splenius capitis/cervicis; longissimus capitis/cervicis. Recruitment depends on posture and resistance.
Conditional contributors	Upper trapezius and levator scapulae can contribute when the scapula is sufficiently fixed. Ipsilateral semispinalis and deep segmental muscles may assist control.
Smaller and supporting muscles	Rectus capitis lateralis and intertransversarii may contribute to upper or segmental side flexion. Opposite-side muscles may coactivate or lengthen; they are not necessarily the principal loaded side.

Relation to a side-bending stretch

A seated side bend away from a held-down shoulder can lengthen tissues on that shoulder side. A supported ball press towards that side instead asks the same-side muscles to contract. The stretch and resistance phases should be described separately. [30,32,33]

What can and cannot be claimed

Controlled lateral resistance is biomechanically plausible as neck conditioning. No direct trial of this ball-supported position establishes pain relief, corrected posture, greater flexibility or an appearance benefit.

Keep the shoulder relaxed rather than shrugging to compress the ball. Shoulder effort can dominate the task and obscure the intended neck load.

06 / COMPARABLE MOVEMENTS AND THEIR LIMITS

Connections to physiotherapy and yoga

Recognised exercises offer useful context, but their effects belong to the studied protocol. A common movement direction is not evidence that a consumer ball exercise produces the same clinical result.

Established exercise	Muscular emphasis	Documented effect or purpose	Transfer to Nexaball
Ball-assisted CTAR	Suprahyoid group; individual contribution unresolved.	Related studies measure recruitment and training-related group activity. [1, 5]	Closest analogue to straight chin compression; product and dose remain different.
Low-load craniocervical flexion or chin nod	Longus colli and longus capitis; superficial flexors monitored for compensation.	A small six-week study linked increased deep-flexor activity with pain reduction. [14]	Similar flexion direction, but no proof that ball compression selectively trains the deep flexors.
Seated active neck rotation	Opposite-side sternocleidomastoid and same-side splenius among likely movers.	NHS guidance uses comfortable rotation to promote mobility and flexibility. [32,33]	Comparable direction; unloaded mobility does not establish resisted exercise benefit.
Seated side-bend or neck stretch with shoulder held down	Lengthening of opposite-side cervical tissues; upper trapezius and scalenes are plausible stretch targets depending on position.	NHS guidance describes gentle side bending for neck mobility or stretching. [32,33]	A stretch away from the ball side differs from a resisted press towards it.
Iyengar yoga programme	Whole-body posture, shoulder mechanics, breathing and multiple cervical tasks; no single-muscle ranking.	Nine-week randomised trials reported improved pain and disability; one also assessed range of motion and proprioception. [16, 17]	Programme-level clinical evidence; no individual pose or ball exercise was isolated.

What a stretch actually establishes

A stretch is intended to lengthen a tissue or explore range. An isometric contraction creates force with little visible movement. Neither should automatically be described as hypertrophy training. The muscles felt during a stretch are not necessarily those making the movement.

Clinical evidence is not a product claim

Evidence for combined strengthening and stretching in chronic neck pain is more favourable than evidence for stretching alone, but certainty and dosage vary. The clinical population, supervision and programme matter. [15]

07 / STUDY DESIGN AND POPULATION

Measured resistance exercise findings

The studies below support recruitment or adaptation in related exercises. Acute activation, post-training activity, muscle thickness and a patient-important outcome are separate endpoints.

Study and population	Protocol or comparison	Measured finding	Important limit
Yoon et al 2014 40 healthy adults [1]	Ball-assisted CTAR versus Shaker head lift.	Higher maximum suprahyoid sEMG in CTAR; sustained CTAR also showed higher mean activity.	Acute comparison, not long-term product efficacy.
Sze et al 2016 39 healthy adults [2]	CTAR versus Shaker with simultaneous muscle recording.	More selective suprahyoid loading; less sternocleidomastoid activation and fatigue.	Group signal, not isolated individual-muscle recruitment.
Kilinc et al 2020 36 healthy volunteers [5]	Eight-week CTAR, band-assisted chin tuck or Shaker.	CTAR and band groups improved maximal suprahyoid activity and tongue pressure.	No significant change in dysphagia limit; no contour outcome.
Choi et al 2020 30 stroke patients [7]	Six weeks of resisted jaw opening or head lifts.	Digastric and mylohyoid thickness and hyoid motion increased in both groups.	No significant between-group difference; clinical cohort.
Cho et al 2023 24 older adults [8]	Six-week resisted swallowing with tensioned tape versus placebo tape.	Greater suprahyoid activity and digastric/mylohyoid thickness with resistance.	Swallowing task with tape, not ball compression.
Park et al 2024 34 older adults [6]	Six-week multidirectional versus vertical spring-device CTAR.	Greater tongue pressure, tongue thickness and mean suprahyoid activity in multidirectional group.	Peak sEMG did not differ; device geometry is not Nexaball.
Park et al 2026 30 older adults with oral hypofunction [9]	Neck-collar resistance device versus sham device.	Greater group activity and thickness; improved penetration-aspiration scores.	Different device and clinical population; not consumer-product validation.

sEMG means surface electromyography. A submental electrode records a regional signal; it cannot reliably rank every deep suprahyoid muscle. Thickness measures are structural surrogates and do not by themselves demonstrate improved appearance.

08 / A PLAUSIBLE CHAIN WITH MISSING LINKS

Hyoid support and submental contour

Ageing and the hyoid

The geniohyoid helps link the mandible and hyoid. CT observations associate ageing with reduced geniohyoid cross-sectional area and greater fatty infiltration. These associations help explain a muscular rationale but are not proof that a given exercise reverses ageing. [24]

A 282-scan study found age-related downward hyoid movement in both sexes and BMI-related forward movement. Measurements came from supine CT; the authors call for comparison with upright positioning. [23]

Exercise and resting position

Matsubara et al studied 21 community-dwelling older adults with swallowing-related symptoms, not an entirely symptom-free cosmetic cohort. Four weeks of rapid jaw opening was associated with an approximately 4.5 mm rise in resting hyoid position. No control group or direct contour assessment was included. [10]

The proposed explanation involved muscle hypertrophy or altered tone, but this study did not directly establish the hypertrophy mechanism. Its rapid jaw-opening regimen should not be copied as a general Nexaball prescription.

The key unresolved step

Even if a related exercise changes hyoid position, it is unknown whether the change produces a visible improvement in the chin-to-neck angle. Head posture, fat distribution, skin laxity and individual anatomy may substantially modify the result.

Anatomical and surgical context

An anatomical study describes a hyoplatysmal ligament linking the hyoid, platysma and submental tissues and proposes a role in the neck angle. It provides an anatomical explanation, not an exercise efficacy trial. [25]

A prospective surgical cohort compared 20 hyoid-myotomy-and-suspension patients with 11 septoplasty controls. At six weeks, adjusted differences favoured surgery for the cervicomental angle and two FACE-Q modules. The adjusted angle difference was about 10 degrees. [26]

Surgery changes tissues and fixation directly. It cannot be used to predict the result of a small exercise-related positional change, and this observational comparison does not establish an exercise mechanism.

Evidence across the proposed chain

Resistance to muscle recruitment: directly measured in related protocols. **Repeated loading to adaptation:** measured in selected studies.

Training to resting hyoid position: a small uncontrolled signal. **Exercise to visible contour:** not established for a ball programme.

Interpretation

The chain is a research hypothesis. It is unsuitable as a claim that Nexaball lifts the neck, tightens sagging skin, removes a double chin or reproduces a surgical effect. Muscle conditioning is the defensible emphasis; appearance needs a direct trial.

Skin appearance and wider clinical context

Small facial exercise studies

An eight-week resistance programme in 16 women reported changes in skin firmness and elasticity, including neck measurements. A separate facial-device study in 50 women reported increased digastric cross-sectional area and changes in lower-face surface measures. Both used pre-post designs without a concurrent control. [18, 19]

A face-yoga study in 12 women reported muscle-specific changes in myotonometry over eight weeks, including increased digastric tone and stiffness. These mechanical measurements are not the same as increased strength or a clinically visible neck-contour improvement. [20]

A controlled seven-week facial-exercise study could not establish effectiveness, and a systematic review found the available evidence insufficient to conclude that facial exercises rejuvenate appearance. [21, 22]

Whole-body exercise and skin

A 16-week study analysed 56 middle-aged women after aerobic or resistance training. Both groups improved selected skin measures, while resistance training also improved dermal thickness. This was systemic training, not a neck-ball experiment. [27]

It is reasonable to place a small neck routine within broader physical activity. It is not reasonable to attribute whole-body dermal effects to local ball compression.

Yoga and therapeutic programmes

Randomised Iyengar yoga trials found improvements in selected chronic-neck-pain outcomes over nine weeks. The interventions combined multiple postures, attention to alignment and supervised practice; improvement cannot be assigned to one neck movement or one muscle. [16, 17]

The Cochrane neck-exercise review found moderate-quality evidence for some strengthening or combined programmes, while stretching-only findings were less convincing. The absence of high-quality evidence and variation between trials constrain broad promises. [15]

Swallowing and sleep research

Oropharyngeal-exercise trials in sleep-apnoea populations reported reduced neck circumference and other outcomes; one programme was added to CPAP. Those multi-muscle clinical programmes neither tested Nexaball nor measured a cosmetic neck angle. Circumference is not contour. [28, 29]

Blood flow and platysma

A local perfusion explanation for neck appearance remains untested here. The platysma is a superficial expression muscle; deliberately grimacing or clenching is not required for these exercises. Increasing its recruitment should not be presented as a proven anti-ageing strategy.

Different anatomical layers require different questions. Exercise does not physically remove excess skin or local fat, and indirect muscle evidence cannot substitute for a cosmetic outcome measurement.

10 / NEXT STEPS FOR A CREDIBLE EVIDENCE BASE

Interpretation and product validation

What can be said now

Nexaball can be described as a tool intended for controlled neck resistance and guided movement. Published CTAR work supports an underlying muscular-loading rationale. The rotation and lateral positions broaden the intended movement pattern but are not independently clinically validated.

Muscle lists should state whether they describe a measured group signal, a documented result from another protocol or an anatomical inference. Avoid claims that all named muscles are equally trained or that a photograph proves selective activation.

Safety and suitability

The source leaflet recommends gentle pressure, slow movement, relaxed shoulders and normal breathing. Its five-repetition, five-second-hold guidance is manufacturer guidance, not a validated product-specific dose.

Do not use with an existing neck condition, acute injury, unexplained pain or relevant cervical-spine problem without qualified advice. Previous neck treatment or injury also warrants advice. Stop immediately for pain, dizziness or discomfort. Never force rotation or combined end-range rotation and extension.

Ball firmness and contact area alter forces. Photographs do not specify a safe pressure. The fitness and wellness positioning does not imply diagnosis, treatment or prevention of medical conditions.

Conclusion

The strongest basis is targeted muscular conditioning. Related therapeutic and yoga evidence provides context, not transferable product efficacy. Cosmetic change remains a hypothesis requiring direct measurement.

First study the exercise mechanics

Compare straight compression, leaflet rotation roll, rotated compression and lateral pressing under standardised posture and force. Record bilateral sternocleidomastoid, splenius and upper-trapezius signals with submental sEMG; use validated methods for deeper or individual muscles where feasible.

Measure ball force or deformation, range of motion, jaw behaviour and shoulder movement. Assess comfort and adverse events. Surface electrodes alone will not resolve every deep muscle or establish a reliable hypertrophy ranking.

Then test training outcomes

A randomised trial could compare Nexaball training with a matched low-load control. Prespecify dose, progression, adherence, safety reporting and a sample size based on a meaningful primary outcome. Blinded outcome assessment and follow-up after training stops would strengthen inference.

If muscular adaptation is primary, use reproducible ultrasound and functional measures. If appearance is the question, prespecify standardised upright photography, blinded contour assessment and a patient-reported appearance measure. Include body composition and posture so they can be distinguished from the intervention.

Limitations of this review

This targeted narrative update is selective. Several results are abstract-level findings, populations differ and study doses are not interchangeable. No Nexaball-specific muscle-activation or outcome trial was identified in the material assessed.

The supplied anatomy figure is retained for orientation; it should not be used as a definitive anatomical atlas. Exact muscle recruitment and safe loading need measurement, not increasingly detailed anatomical speculation.

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Source material: Steven Bookbinder, Resistance Exercise and Submental Contour, September 2026; supplied Nexaball leaflet and product photographs. The original review and this targeted update are narrative syntheses, not peer-reviewed product trials. Bibliographic dates above follow the current retrieved records.