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***AN EXAMINATION OF VOCAL WARM-UP
PRACTICES IN VOICE PEDAGOGY: IMPLICATIONS
FOR BELTING IN NOVICE ADULT WORSHIP
SINGERS***

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1. COMPONENT 1

1.1. INTRODUCTION AND RATIONALE

This study is rooted in a practice-led approach, drawing on my experience as a vocal coach in Switzerland working primarily with beginner adult worship singers. In this setting, Contemporary Commercial Music (CCM), especially worship music, requires singers to meet specific stylistic and expressive demands, with belting serving as a key expressive method to convey intensity and authenticity (Turner, 2008; Sundberg, Thalén and Popeil, 2012; LoVetri et al., 2024).

Vocal warm-ups are widely recognised as important in voice training to prepare singers for performance demands (Amir et al., 2005; Gish et al., 2012; Hoch and Sandage, 2018; Zuim et al., 2024), yet their physiological effects remain only partially supported by evidence, and no consensus exists regarding their pedagogical application (Gish et al., 2012; Portillo et al., 2018). Substantial variation in warm-up methods and inconsistent objective findings persist despite commonly reported improvements in perceived voice quality (Gish et al., 2012; Hoch and Sandage, 2018). Literature addressing warm-ups in CCM and worship singing specifically remains limited (Hoch and Sandage, 2018; Zuim et al., 2024), which matters because warm-ups are used not only for general readiness but also to support coordination for demanding techniques such as belting, where task-specific preparation and cumulative vocal load are particularly relevant (Hoch and Sandage, 2018; Zuim et al., 2024).

Historically, belting has been associated with vocal risks (Edwin, 2007; McGlashan, Thuesen and Sadolin, 2017; LoVetri et al., 2024), though recent research reconceptualises it as a coordinated, speech-like vocal mode that, when appropriately supported, can be both effective and sustainable (Spivey, 2008; Ikävalko and Laukkanen, 2025). Inconsistent terminology and pedagogical approaches nonetheless continue to complicate practical application (Bourne and Kenny, 2016; Popeil, 2007).

This research, therefore, examines how vocal warm-ups may support sustainable belting among novice adult worship singers, to inform pedagogical approaches within CCM and worship contexts.

1.2 PLANNED PROGRAM OF STUDY

1.2.1 THEORETICAL INFLUENCES

Voice production is a complex coordination of respiratory airflow, laryngeal adduction, and vocal tract resonance that requires continuous adjustment in response to vocal task demands (Herbst et al., 2023; Portillo et al., 2018). Within singing pedagogy and voice science, vocal warm-up is widely regarded as a foundational preparatory practice intended to optimise phonatory efficiency, support vocal readiness, and potentially reduce fatigue associated with performance demands (Riquelme-Muñoz et al., 2025; Hoch & Sandage, 2018; Portillo et al., 2018). Despite its widespread use, however, there remains limited consensus regarding what constitutes an effective warm-up, with substantial variation in duration, structure, and exercise selection across singers, genres, and pedagogical traditions (Gish et al., 2012; Vintturi et al., 2001; Hoch & Sandage, 2018). Warm-up routines may range from five-minute preparations to protocols exceeding thirty minutes and are often shaped more by stylistic convention than empirical standardisation (Gish et al., 2012).

This diversity reflects a broader distinction within vocal pedagogy between warm-up as repertoire-based technical preparation and warm-up as physiologically informed vocal conditioning (Hoch & Sandage, 2018). Traditional warm-ups commonly emphasise scales, resonance exercises, and stylistic vocalises linked to technical skill development. In contrast, semi-occluded vocal tract exercises (SOVTEs), including straw phonation and LAX VOX, are increasingly framed as physiologically efficient exercises that may improve vocal economy by reducing phonation threshold pressure and vocal fold collision force (Portillo et al., 2018; Manternach, 2024). Although both approaches are associated with improved self-perceived vocal readiness, Portillo et al. (2018) identified aerodynamic differences suggesting that traditional open-vowel warm-up may contribute to greater phonatory load and early vocal fatigue

compared with SOVTE-based approaches. Concerns surrounding fatigue management and cumulative vocal load are also reflected in Hoch and Sandage's (2018) observation that fatigue resistance and recovery remain underrepresented in established warm-up pedagogies.

The literature increasingly positions warm-up not as a uniform physiological intervention but as a form of coordination priming shaped by task specificity, vocal style, cumulative vocal load, and individual variability (Hoch & Sandage, 2018; Portillo et al., 2018). These considerations are particularly relevant in Contemporary Commercial Music (CCM) belting, a high-intensity, speech-influenced phonatory strategy characterised by elevated subglottal pressure and strong vocal fold contact (Spivey, 2008). Such issues may be especially significant for novice adult worship singers, who frequently perform demanding CCM repertoire despite limited access to pedagogical guidance informed by vocal fatigue and load management (Hoch & Sandage, 2018; Zuim, Stewart & Titze, 2024).

1.2.2 AIM OF THE STUDY

This study aims to explore how vocal warm-up practices are conceptualised within academic literature, and to consider how insights drawn from the literature can be meaningfully applied to the development of sustainable belting technique in novice adult worship singers.

1.2.3 OBJECTIVES OF THE STUDY

The following objectives have been identified to guide and structure the inquiry:

- To explore and synthesise existing literature on vocal warm-up theory through a review of peer-reviewed sources.
- To examine vocal warm-up approaches relevant to belting in CCM and novice worship singers by analysing peer-reviewed literature and frameworks.
- To identify key themes, principles, and recurring strategies within the literature through a review and comparison of selected sources.
- To consider the application of these insights to novice adult worship singers engaging in belting by relating findings to worship singing practice.

1.2.4 PERSONAL LEARNING OUTCOMES

Through the completion of this study, the researcher aims to:

- Develop an evidence-informed understanding of vocal warm-ups and their potential role in supporting sustainable belting within CCM contexts.
- Critically and reflectively engage with literature relating to vocal warm-up, belting, and vocal pedagogy.

- Strengthen skills in conducting an exploratory narrative literature review, including the analysis, synthesis, and interpretation of diverse sources of evidence.
- Develop reflexive awareness of how personal experience as a worship singer, belter, and vocal coach in Switzerland shapes the interpretation and application of research findings.
- Apply theoretical and pedagogical insights to develop context-sensitive warm-up approaches for novice adult singers in studio and worship settings.

PROJECT TIMELINE

PROJEKTTITEL

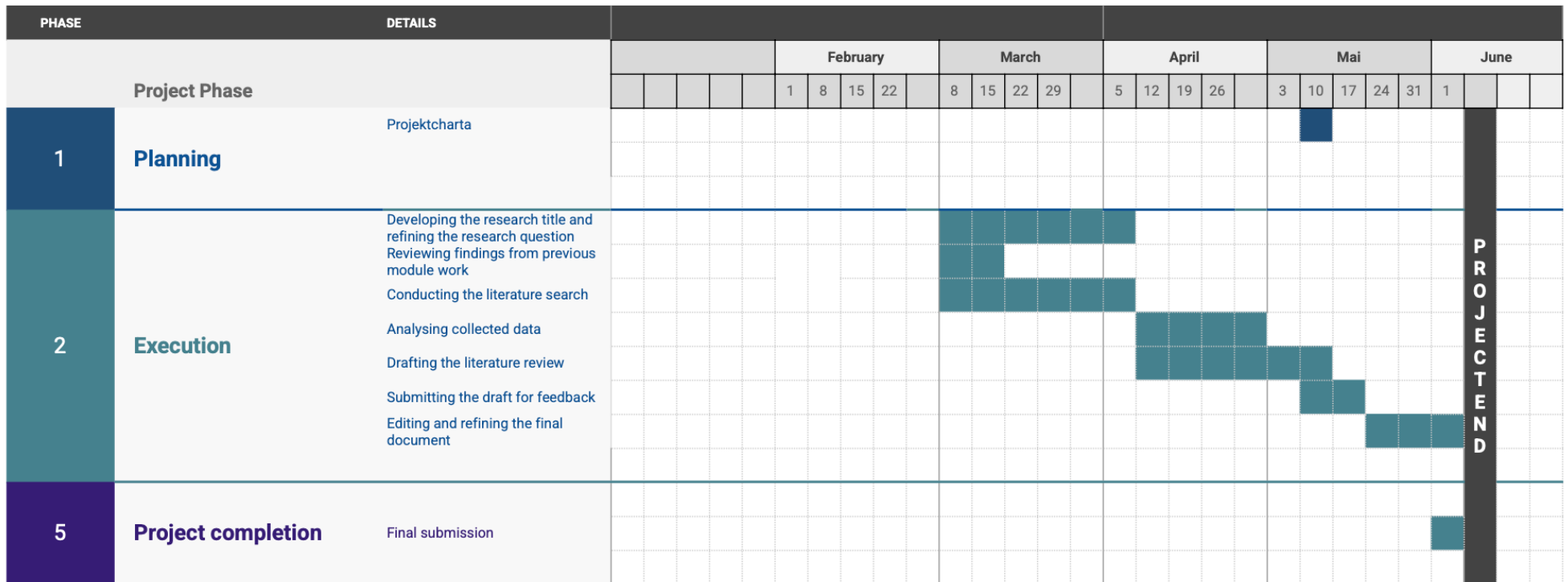
AN EXPLORATION OF VOCAL WARM-UP PRACTICES IN VOICE PEDAGOGY: IMPLICATIONS FOR BELTING IN NOVICE ADULT WORSHIP SINGERS

PROJEKTMANAGER

Gloria Kull

DATE _____

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1.3 METHODOLOGY

This study adopts a narrative literature review methodology to explore vocal warm-up practices in voice pedagogy and their implications for belting development in novice adult worship singers within Contemporary Commercial Music (CCM). The study examines how warm-up strategies are discussed across voice science, vocal pedagogy, and practitioner literature, and evaluates their relevance for sustainable belting development in applied teaching contexts.

A narrative review is appropriate due to the interdisciplinary nature of the literature, which spans voice science, pedagogy, and practitioner knowledge (Scott, 2022). Unlike systematic reviews requiring narrowly defined datasets and methodological homogeneity, narrative reviews enable interpretive synthesis across diverse epistemologies and are suited to practice-informed research (Grant and Booth, 2009; Snyder, 2019). As with all narrative literature reviews, this approach is potentially susceptible to selection bias because of the interpretive nature of source selection and synthesis (Snyder, 2019). To mitigate this, the review employed a staged, transparent search strategy, defined inclusion and exclusion criteria, and engaged in comparative analysis of diverse literature sources.

The study is grounded in a constructivist epistemology, which assumes knowledge is co-constructed through interaction between researcher, literature, and context (Scott, 2022). Vocal pedagogy knowledge is therefore understood as situated and context-dependent rather than fixed or universal (Charmaz, 2017). My professional role as a vocal coach in Switzerland and my experience as a worship singer inform interpretation. This is positioned as a reflexive lens rather than authority. Reflexivity is maintained through ongoing critical reflection to ensure transparency in interpretation (Mercer, 2007; Tracy, 2010).

The research question was developed using the FINER framework (Feasible, Interesting, Novel, Ethical, Relevant) to ensure clarity and applied value (Covvey, McClendon & Gionfriddo, 2024). The study is

feasible due to accessible literature in voice science and pedagogy. It is interesting because it addresses the underexplored relationship between vocal warm-ups and belting development. It is novel in its focus on novice adult worship singers within CCM. It is ethical as it involves no human participants. It is relevant because of direct implications for voice pedagogy and studio-based practice.

The literature search was conducted in stages to progressively refine focus (Grant and Booth, 2009). An initial broad search explored vocal warm-up literature within voice pedagogy to establish key concepts and areas of discussion. This was followed by a more focused search on Contemporary Commercial Music (CCM) and musical theatre vocal training because of their relevance to worship singing and belting, as well as the limited availability of worship-specific academic literature. The final stage focused on CCM belting contexts to explore how vocal warm-up practices are discussed in relation to vocal coordination and sustainable belting development. This iterative approach reflects the flexible search strategies associated with scoping and narrative literature reviews (Grant and Booth, 2009).

In line with Grant and Booth (2009), rigour in such review approaches is linked to transparency in reporting search, selection, and synthesis processes rather than adherence to a fixed systematic protocol. The included literature was examined comparatively to identify recurring themes and areas of similarity and difference across pedagogical and voice science perspectives (Snyder, 2019). This approach supports synthesis across diverse literature where terminology and conceptual frameworks may vary.

Most sources are peer-reviewed literature. These sources provide the empirical foundation, particularly in vocal physiology and acoustics (Gish et al., 2012; Portillo et al., 2018; Ikävalko & Laukkanen, 2025).

Inclusion criteria required relevance to vocal warm-ups, belting technique, or Contemporary Commercial Music (CCM) pedagogy. Exclusion criteria

removed sources lacking methodological transparency or limited to non-transferable classical frameworks. A post-2000 publication range was applied to ensure alignment with contemporary CCM vocal science and belting research developments. Search terms included combinations of “vocal warm-up”, “voice pedagogy”, “belting”, “Contemporary Commercial Music”, “CCM singing”, “worship singing”, “musical theatre singing”.

The analysis is interpretive and guided by the research question. Given the narrative and interpretive design of this review, no formal data extraction framework is employed. Instead, findings are discussed across sources to explore how warm-up practices are understood in relation to coordination and sustainable belting in novice worship singers. Interpretation is grounded in constructivist epistemology and reflexive positioning, acknowledging that both the literature and practitioner experience shape findings.

2. COMPONENT 2

2.1. INTRODUCTION

This literature review explores the academic research relevant to vocal warm-up practices, their physiological and pedagogical foundations, and their specific implications for the development of sustainable belting technique in novice adult singers within Contemporary Commercial Music (CCM) contexts (Gish et al., 2012; Hoch and Sandage, 2018; Portillo et al., 2018; Manternach, 2024). A particular focus is placed on novice adult singers in worship settings (Gish et al., 2012; Hoch and Sandage, 2018; Portillo et al., 2018; Manternach, 2024).

The review is organised thematically across seven areas: definitions and foundational debates surrounding vocal warm-up; exercise science principles related to warm-up; vocal warm-up practices, perceptions, and physiological evidence; semi-occluded vocal tract exercises; vocal demands and cumulative phonatory load in CCM performance; mind-body preparation in ensemble singing contexts; and physiological and pedagogical debates surrounding belting as a vocal technique (Manternach, 2024; Riquelme-Muñoz et al., 2025; Zuim, Stewart and Titze, 2024; Katada, Yoshida and Kita, 2025; Spivey, 2008; Seton, Maxwell and Szabó, 2019).

This organisational structure follows the three-stage search strategy described in the methodology, reflecting a staged and iterative approach to literature searching and synthesis (Grant and Booth, 2009), with each stage contributing progressively to the development of the analysis in relation to the central research question. The review identifies areas of convergence in the literature, as well as apparent gaps in research relating to novice singers and worship contexts, where dedicated academic literature remains limited (Gish et al., 2012; Hoch and Sandage, 2018). Ultimately, the review seeks to identify principles that could inform the design of contextually appropriate warm-up practices for novice adult worship singers learning to belt sustainably within the CCM repertoire.

When sources are drawn from another author's paper rather than read independently, this is signalled explicitly by the phrase "cited in," in keeping with transparent secondary citation practice. A glossary will also be included in the appendices, providing definitions for some terms.

2.2. LITERATURE REVIEW

2.3. DEFINITIONS AND FOUNDATIONAL DEBATES IN VOCAL WARM-UP RESEARCH

Vocal warm-up is widely regarded in both the academic and practitioner literature as a preparatory practice fundamental to safe and effective singing performance (Gish et al., 2012; Hoch and Sandage, 2018).

Despite this widespread acceptance, the term covers an enormously varied range of activities, physical stretching, breathing exercises, scale-based vocalises, resonance exercises, semi-occluded phonation tasks, and psychological preparation, and there is no agreed standard for what a warm-up should contain, how long it should last, or what it should achieve (Gish et al., 2012; Hoch and Sandage, 2018).

This definitional breadth reflects a broader conceptual issue within vocal pedagogy. Hoch and Sandage (2018) note that, within much of the historical voice-teaching tradition, vocal warm-up has primarily been associated with acquiring the skills needed to perform specific repertoire. An examination of widely used historical pedagogical methods, including those of Vaccai, Concone, Panofka, and Marchesi, shows that these approaches are largely organised around vocalises—melodic exercises designed to develop technical elements such as legato, agility, and stylistic control within the classical vocal tradition (Hoch and Sandage, 2018). Within this tradition, explicit attention to fatigue management is limited, particularly in belting contexts, where sustained high-intensity phonation increases vocal load and recovery demands. This contrasts with exercise science perspectives, which frame warm-up not only as technical preparation but also as part of broader processes of conditioning, fatigue management, and recovery (Hoch and Sandage, 2018). At the same time, Hoch and Sandage (2018) suggest that the physiological mechanisms underlying the benefits of vocal warm-up are not yet fully understood within the field, reflecting ongoing gaps between pedagogical practice and voice science. As a result, translating findings

from vocal warm-up research into specific, generalisable recommendations across singing styles and populations remains complex (Hoch and Sandage, 2018; Portillo et al., 2018). This complexity is further increased in Contemporary Commercial Music (CCM) and worship singing contexts, where stylistic demands and vocal production strategies may differ significantly from the classical tradition that underpins much of the existing warm-up literature (Hoch and Sandage, 2018; Spivey, 2008).

The broader performance training literature suggests that warm-up is not only physiological preparation but also part of overall performance preparation routines (Seton, Maxwell and Szabó, 2019). Seton, Maxwell, and Szabó (2019), in a large-scale survey of actors, found that vocal warm-up is a common preparatory practice and is often combined with physical preparation strategies such as flexibility and endurance work. Their findings also suggest variation in how performers manage transitions out of performance, with recovery practices appearing less structured than preparation routines (Seton, Maxwell and Szabó, 2019). While these findings are specific to actors, they may apply more broadly, including CCM singing, where vocal cool-downs are less common (Gish et al., 2012; Seton, Maxwell and Szabó, 2019). In contexts of frequent vocal load, such as rehearsals and performances in worship, the limited focus on recovery practices could impact long-term vocal sustainability.

2.4. EXERCISE SCIENCE AND VOCAL WARM-UP

Exercise science identifies three principles particularly relevant to warm-up design: specificity, overload, and reversibility (Hoch and Sandage, 2018). The specificity principle states that changes in muscle function are highly specific to the type of exercise performed, even when the same muscle groups are involved, because particular tasks recruit distinct neuromuscular patterns (Hoch and Sandage, 2018). For singing, this means warm-up exercises should be grounded in the specific coordination demands of the repertoire to be performed. Hoch and Sandage (2018) make this point directly: classical Italian vocalises designed for operatic agility address fundamentally different coordination patterns from those required in CCM styles such as belting, which involves a distinct laryngeal configuration and vocal tract shaping rather than simply a different pitch range. Effective warm-up for belting therefore requires exercises that engage the specific muscular and resonance patterns of that style rather than defaulting to classically derived scale work (Hoch and Sandage, 2018; Spivey, 2008).

The overload principle describes the need to work muscle tissue beyond its habitual level to produce physiological adaptation, while reversibility indicates that adaptations will diminish if training intensity falls below a maintenance threshold (Hoch and Sandage, 2018). Together, these principles suggest that warm-up is not simply a preparation ritual but part of a cumulative conditioning process with implications for long-term vocal development (Hoch and Sandage, 2018). Drawing on exercise physiology research by Brooks, Fahey and Baldwin (2005) and Pearce, Rowe and Whyte (2012), both cited in Hoch and Sandage (2018), the authors note that warm-up in athletic contexts enhances performance by elevating tissue temperature, which accelerates both enzyme activity and neural impulse conduction, meaning the speed at which nerve signals activate muscles, contributing to more efficient and responsive muscular function. Because vocal warm-up involves active muscular work with a metabolic cost, it should be understood as part of a continuum of vocal

activity that contributes to overall physiological load rather than as a preparation phase separate from performance (Hoch and Sandage, 2018).

A review of established voice pedagogy programmes by Hoch and Sandage (2018) found that fatigue resistance and recovery considerations are largely absent from existing warm-up approaches. Even Miller (1986), cited in Hoch and Sandage (2018), despite providing detailed physiological commentary on vocal technique, does not explicitly address fatigue management within warm-up design. Similarly, although Titze (2000), as referenced by Hoch and Sandage (2018), incorporates exercises such as lip and tongue trills and phonation in narrow tubes to emphasise vocal efficiency, there is still a lack of a systematic method for fatigue-informed warm-up. From my perspective, this gap is particularly consequential for novice CCM and worship singers, whose vocal load may be substantial yet whose access to fatigue-informed pedagogical guidance remains limited, a concern the following sections address through evidence on SOVTE-based warm-up and vocal dose.

2.5. VOCAL WARM-UP PRACTICES, PERCEPTIONS, AND PYSIOLOGICAL EVIDENCE

Gish et al. (2012) provide one of the most comprehensive accounts of vocal warm-up practices among singers across undergraduate, postgraduate, and professional levels. Their survey of 117 singers revealed that warm-ups are widely adopted routines, with 54% of participants always completing one before singing and 34% usually doing so. The most common warm-up duration was relatively brief at five to ten minutes (32%), with very few participants engaging in preparation exceeding thirty minutes. This suggests that warm-ups are generally conceptualised as short routines rather than extensive training processes.

In terms of content, singers most frequently reported stretching of the face, neck, and shoulder musculature (62%), breathing exercises (55%), and postural alignment work (50%) (Gish et al., 2012). Singing-based exercises commonly included rapid five-note scales (52%), octave scales (32%), and glissandi, meaning smooth pitch slides through the vocal range, alongside lip and tongue trills (Gish et al., 2012). Singers reported greater use of warm-up before solo performance (75–90%) compared with ensemble contexts (29–62%), a pattern directly relevant to group worship settings where individual preparation is frequently absent (Gish et al., 2012).

Perceptually, warm-up was strongly associated with positive subjective outcomes: 72% of participants strongly agreed it is important, 74% reported improved vocal cooperativeness, and 70% perceived increased flexibility following warm-up (Gish et al., 2012). However, only 39% strongly agreed that warm-up prevents vocal injury, suggesting that singers primarily view warm-up as a tool for immediate readiness rather than long-term protection (Gish et al., 2012).

While Gish et al. (2012) describe what singers do and believe, they do not determine whether different warm-up strategies produce distinct

physiological effects. This gap is addressed by Portillo et al. (2018), who directly compared physiological warm-up, based on semi-occluded vocal tract exercises, with traditional singing warm-up in a controlled study involving thirty CCM singers. Participants completed a fifteen-minute warm-up of either type, with aerodynamic, electroglottographic, acoustic, and self-perceived voice quality measures recorded before and after. The central finding was that no significant differences emerged between the two approaches across objective or subjective measures, indicating broadly comparable short-term outcomes (Portillo et al., 2018). Both groups reported improved voice quality immediately following warm-up, consistent with the survey findings of Gish et al. (2012) and suggesting that the subjective sense of improved ease and resonance is a reproducible outcome of warm-up regardless of exercise type (Gish et al., 2012; Portillo et al., 2018).

However, Portillo et al. (2018) also identified important physiological nuances. The traditional warm-up group showed a significant decrease in sound pressure level alongside increased glottal airflow and decreased aerodynamic efficiency, a pattern the authors identified as potentially indicative of an early stage of vocal fatigue or loading effect, consistent with markers of hypofunctional glottal behaviour described in the broader fatigue literature, though the authors note that interaction effects did not reach conventional significance thresholds (Portillo et al., 2018). The physiological warm-up group did not exhibit these aerodynamic changes, suggesting a more stable phonatory pattern following SOVTE-based exercise (Portillo et al., 2018). Crucially, these physiological differences did not translate into differences in perceived vocal quality between groups, suggesting a dissociation between subjective improvement and measurable aerodynamic changes (Portillo et al., 2018).

This disconnection is not isolated to Portillo et al. (2018). Moorcroft (2011), in a doctoral study examining acoustic and perceptual change following a twenty-five-minute vocal warm-up in trained female singers, found that while warm-up produced measurable acoustic improvements

in vibrato regularity and stability, under controlled back-to-back listening conditions, listener-judges were unable to reliably identify which vocal samples had been produced following warm-up, with correct identification occurring at rates approaching chance (Moorcroft, 2011). Notably, perceptual detection of warm-up improvement was largely limited to singers whose pre-warm-up vibrato was already most acoustically deviant, meaning those with the fastest, slowest, or most irregular rates (Moorcroft, 2011). For singers with more moderate and stable baseline vocal production, external listeners showed considerable intra- and inter-judge unreliability, even when acoustic change was objectively verified (Moorcroft, 2011). This finding substantially complicates the warm-up literature's reliance on perceptual outcomes as evidence of warm-up efficacy: improvements that feel significant to the singer may not be reliably detectable by an external listener and may not correspond to meaningful changes in phonatory efficiency.

These findings resonate with the practitioner experience informing this study. In applied work with novice worship singers, warm-up has consistently produced a subjective sense of readiness and ease regardless of the specific exercises used, a pattern consistent with the robust perceptual outcomes reported across the literature (Gish et al., 2012; Portillo et al., 2018). At the same time, the dissociation identified by Moorcroft (2011) and the aerodynamic differences observed by Portillo et al. (2018) suggest that this subjective readiness may not fully reflect the underlying physiological state, a consideration that has shaped the attention given in this study to SOVTE-based approaches over traditional open-vowel warm-up as preparation for belting. This may be particularly significant for novice worship singers, who may have less developed bodily awareness and therefore be less able to distinguish between a subjective sense of vocal readiness and underlying phonatory efficiency or fatigue. In CCM and worship singing contexts, where vocal load can vary substantially across rehearsal and performance cycles, this raises important questions about whether individualised approaches may

be more relevant than standardised prescriptions. This is a consideration that follows from the evidence reviewed here rather than from any single source, and one taken up in subsequent sections in relation to vocal dose and SOVTE-based preparation.

2.6. SEMI-OCCLUDED VOCAL TRACT EXERCISES

Semi-occluded vocal tract exercises, commonly abbreviated as SOVTEs, are a family of vocal exercises sharing a common feature: a partial blockage or narrowing at the front end of the vocal tract, typically at the lips or through a tube or straw placed between the lips (Portillo et al., 2018; Riquelme-Muñoz et al., 2025). The group includes humming, lip trills, tongue trills, straw phonation, and resonance tubes such as the LAX VOX tube (Portillo et al., 2018; Riquelme-Muñoz et al., 2025). What unites these activities is that the partial blockage increases intraoral air pressure and alters the pressure conditions above the vocal folds, producing a range of beneficial effects on voice production. (Portillo et al., 2018; Riquelme-Muñoz et al., 2025).

The primary physiological mechanism is that the increased intraoral pressure alters the pressure conditions above the vocal folds and contributes to a reduction in the minimum air pressure needed from below the folds, known as phonation threshold pressure, to sustain vocal fold vibration (Titze, 2006, cited in Manternach, 2024; Portillo et al., 2018). Put simply, the semi-occlusion redistributes aerodynamic conditions in a way that allows the vocal folds to vibrate with less effort. This is associated with reduced vocal fold collision forces, which may decrease mechanical stress on the fold surfaces (Titze and Laukkanen, 2007, cited in Manternach, 2024). Together, these effects are associated with improved vocal economy, meaning increased acoustic output without proportionally greater phonatory effort (Titze and Laukkanen, 2007, cited in Manternach, 2024).

Beyond these phonatory effects, SOVTEs also change the shape of the vocal tract itself, and this is where Manternach (2024) makes an original contribution to the literature. A preliminary MRI-based study by Laukkanen et al. (2012), cited in Manternach (2024), found that straw phonation increased the cross-sectional area of the vocal tract and produced a more elevated soft palate position, creating a larger and more acoustically resonant airway both during and after exercise. A study

by Guzmán et al. (2013), cited in Manternach (2024), found that both pharyngeal widening, meaning a broader throat space, and laryngeal lowering occurred during SOVTE performance. The larynx is the cartilaginous structure housing the vocal folds, and its vertical position significantly affects vocal resonance: a lower position produces the longer vocal tract associated with warmer classical resonance, while a higher position produces the shorter tract associated with the brighter, speech-like resonance of CCM and belting (Popeil, 2007; Bourne and Kenny, 2016)

This apparent paradox, that SOVTEs lower the larynx while belting requires a higher laryngeal position, is resolved through Manternach's (2024) concept of the vocal tract reset. SOVTEs achieve vocal tract expansion passively through mechanical pressure rather than through active muscular effort. Bozeman (2021), cited in Manternach (2024), explains why this matters: virtually all pharyngeal muscles are constrictors, meaning direct attempts to open the throat voluntarily tend to produce tension rather than space. SOVTEs bypass this by expanding the airway through pressure, clearing the tract to a neutral baseline from which the singer can then make deliberate, style-appropriate adjustments, including raising the larynx for belting without the interference of habitual constriction (Manternach, 2024). Although this reset-based interpretation remains relatively recent and has not yet been extensively independently replicated within the literature, his reset function has particular relevance for CCM singers who need to transition between contrasting vocal configurations within a single session (Manternach, 2024; Spivey, 2008).

Manternach (2024) notes, drawing on Maxfield et al. (2015), cited in Manternach (2024), that SOVTEs vary in intraoral pressure generated, with narrow straw phonation producing greater pressures than humming or larger tubes. However, greater pressure does not automatically mean greater benefit, and individual variability in preferred SOVTE type is

consistently reported, meaning finding the most effective exercise for each singer may require guided experimentation (Manternach, 2024). The Blowfish exercise, involving vocalisation through pursed lips with fully puffed cheeks while attending to a sense of posterior pharyngeal expansion, is highlighted as particularly suited to establishing reset because it directs attention to the posterior throat space rather than the forward sensations typical of other SOVTEs (Manternach, 2024). A scoping review by Riquelme-Muñoz et al. (2025), which synthesised 20 PRISMA-compliant studies, found that SOVTEs generally improve voice function. The most consistent effects include better acoustic stability (jitter and shimmer), along with improved vocal comfort, resonance, phonation time, and flexibility. Across studies, singers also consistently reported perceptual benefits, even when acoustic changes were smaller or less consistent, suggesting that subjective improvement may be more reliable than measurable acoustic change in some contexts. Individual studies within the review support these trends in different singer populations, including choral singers using resonance tubes (Cardoso et al., 2020, cited in Riquelme-Muñoz et al., 2025) and gospel singers using silicone tube phonation (Gonçalves et al., 2019, cited in Riquelme-Muñoz et al., 2025), the latter particularly relevant given the stylistic overlap with worship singing. Duke et al. (2015) and Manternach and Daugherty (2019), both cited in Riquelme-Muñoz et al. (2025), found distinct benefits of traditional warm-up and SOVTEs for different acoustic parameters, confirming these approaches serve partially different functions rather than being interchangeable. Riquelme-Muñoz et al. (2025) identify important limitations, including methodological heterogeneity across studies, reliance on subjective measures in several cases, and underrepresentation of amateur singers and those from non-classical backgrounds. These limitations are directly relevant to the present study, since novice adult worship singers represent a population almost absent from the published literature on

SOVTE effectiveness. This gap resonates with the practitioner experience informing the present research. In applied work with beginner adult worship singers in Switzerland, SOVTEs have frequently appeared to produce the sense of vocal ease and openness described in the literature, suggesting they may function as an effective preparatory reset before belting practice. Trialling different SOVTE types across sessions has also reflected the individual variability noted by Manternach (2024), with some singers appearing to respond more readily to straw phonation and others to humming or lip trills, suggesting that exercise selection may require ongoing guided experimentation rather than a fixed protocol.

2.7. VOCAL DOSE: UNDERSTANDING CUMULATIVE VOCAL LOAD IN CCM

The preceding sections have focused on pre-singing warm-up. This section turns to vocal dose, the cumulative phonatory load accumulated across rehearsal and performance, and its implications for warm-up design in CCM singing.

Vocal dose is defined by Titze, Svec and Popolo (2003), cited in Zuim, Stewart and Titze (2024), as comprising four measurable dimensions: time dose, which is the total accumulated duration of phonation; cycle dose, which is the total number of individual vibratory cycles of the vocal folds; distance dose, which is the cumulative distance travelled by the tissue particles in the vocal folds across their oscillatory trajectory. These measures allow researchers to quantify how much mechanical work the vocal fold tissue has performed over a given period, which is a more precise basis for understanding vocal load than the singer's subjective sense of effort alone (Zuim, Stewart and Titze, 2024).

Zuim, Stewart, and Titze (2024) applied dosimetry to six student singers preparing a production of the contemporary musical *Wonderland*, a show that involved extensive chest-dominant singing, with belting and mixed vocal strategies as predominant stylistic features. All participants described their roles as both vocally and physically demanding. The review of the musical score confirmed this assessment, with female lead singers performing within a tessitura, meaning a concentration of sung pitches, surrounding the first passaggio, that is, the transitional pitch zone where the voice shifts between its heavier lower register and its lighter upper register, while frequently employing chest-dominant and belted vocal production (Zuim, Stewart and Titze, 2024). The mean daily distance dose for female singers during rehearsals was 5,203 metres, substantially higher than the mean of 3,766 metres for male singers, a difference likely related to the higher fundamental frequency of the

female singing voice producing more vibratory cycles per unit time (Zuim, Stewart and Titze, 2024).

A particularly important finding of the study was that singers' self-ratings of vocal ease on the EASE questionnaire did not correlate with objective vibration dose (Zuim, Stewart and Titze, 2024). This means that singers' subjective sense of how easy or difficult their voice felt to use was not a reliable indicator of how much mechanical work their vocal fold tissue had actually performed. Zuim, Stewart and Titze (2024) suggest that this disconnection may reflect the gradual accommodation of fatigue, habitual minimisation of discomfort in performance contexts, or limited proprioceptive awareness of cumulative tissue load. For novice singers, who are likely to have even less developed awareness of their own phonatory state, this finding is particularly concerning, since it suggests that relying solely on how the voice feels as a guide to vocal load management may underestimate actual tissue stress.

Research has not yet established normative dose guidelines for musical theatre or CCM singers to identify the threshold between productive vocal use and potentially harmful accumulation (Zuim, Stewart and Titze, 2024). For worship singers who may belt regularly across multiple weekly rehearsals, services, and informal practice sessions, the cumulative nature of vocal dose suggests a potential area of risk that is not directly addressed by warm-up pedagogy alone. Within this context, a well-designed warm-up may help prepare the vocal mechanism and reduce inefficient phonatory behaviour at onset, but it cannot fully account for cumulative load across repeated singing demands (Hoch and Sandage, 2018; Zuim, Stewart and Titze, 2024).

2.8. MIND-BODY PREPARATION IN ENSEMBLE SINGING CONTEXTS

Katada, Yoshida and Kita (2025) investigated four warm-up conditions in twenty-five trained choral singers with five to eighteen years of experience. The conditions were: a breathing condition focusing on slow nasal breathing with attention to respiratory muscle movement; a stretching condition combining gentle joint mobility with slow breathing; an imagery work condition involving kinesthetic imagery, meaning mental simulation of detailed bodily sensations such as being pulled upward or sensing weight through the joints; and an all-works condition combining all three over fifteen minutes. A control condition involved five minutes of quiet sitting. Performance was assessed by the singers and three expert choral conductors, blind to condition, across three domains: vocalisation, sensation, and expression (Katada, Yoshida and Kita, 2025).

Expert evaluations showed that the imagery and all-works conditions significantly improved overall performance compared with control and stretching, while breathing and stretching alone did not yield significant objective gains, although both improved self-reported mood, including reduced tension and anxiety (Katada, Yoshida and Kita, 2025).

Vocalisation improved significantly only in the all-works condition compared with control and stretching, suggesting that technical gains may require combined modalities rather than imagery alone. No significant correlations were found between objective performance and mood changes, indicating that performance improvements were not simply attributable to improved affect. The authors propose that imagery work may enhance performance through relaxed concentration, defined as balanced attentional engagement and flexible kinesthetic control enabling responsive, adaptive singing and enhanced ensemble listening (Katada, Yoshida and Kita, 2025). The breathing condition produced limited effects. It reduced tension and anxiety compared with the control condition but did not significantly improve objective performance (Katada,

Yoshida & Kita, 2025). The authors suggest this may reflect the complexity and short duration of the task rather than a lack of effectiveness. As breathing exercises are widely used in singing pedagogy for breath management and coordination (Douglas and Patenaude-Yarnell, 2005; Collyer, Kenny and Archer, 2011; Gordon and Reed, 2020), their value may depend more on how they are structured and integrated than on their inclusion alone.

A limitation acknowledged by the authors is that the study was conducted online and assessed individual rather than collective performance, which may limit generalisability to live ensemble settings (Katada, Yoshida and Kita, 2025).

Nevertheless, the findings matter for worship contexts precisely because worship singing is not primarily a technical act — it is a communal, expressively motivated practice in which singers need to be present, responsive, and emotionally direct. Physiological warm-up alone might not reliably cultivate these qualities. In the practitioner experience informing this study, novice worship singers frequently arrive carrying tension and self-consciousness, often related to the demands of performing in a live worship setting, that straw phonation or scale work does not resolve, and somatic or imagery-based preparation has consistently appeared more effective at shifting that state. This aligns with Katada, Yoshida and Kita (2025) and with Moorcroft (2011), whose finding that mental imagery alone produced acoustic improvements comparable to vocal warm-up suggests that non-phonatory preparation may be more powerful than the pedagogical tradition has recognised.

2.9. BELTING: PHYSIOLOGICAL CHARACTERISTICS AND IMPLICATIONS FOR WARM-UP

Belting is the predominant expressive vocal mode in CCM and contemporary worship music, characterised by high intensity, speech-influenced quality, and a bright, forward resonance in the mid to upper range (LoVetri, 2002; Spivey, 2008; Sundberg, Thalén & Popeil, 2012; LoVetri et al., 2024). Despite its centrality to these styles, belting remains one of the most pedagogically contested topics in voice training, with disagreements persisting about its physiological basis and safety (Edwin, 2007; Spivey, 2008; McGlashan, Thuesen & Sadolin, 2017; LoVetri et al., 2024).

Spivey (2008) synthesises two opposing positions. The classical-pedagogy position characterises belting as the forcible extension of the chest voice register upward beyond its natural limits, associating it with elevated vocal fold collision force, tissue damage, and long-term vocal deterioration. The CCM pedagogy position, represented by LoVetri (2001) and Edwin (1998), both cited in Spivey (2008), argues that this misidentifies what skilled belting actually involves. Belting is not pure chest voice singing but a coordinated, speech-derived vocal mode that, when executed with proper technique, is physiologically sustainable (Edwin, 2007; Spivey, 2008; McGlashan, Thuesen & Sadolin, 2017; LoVetri et al., 2024). Its characteristics include a high laryngeal position, narrowed pharyngeal width, laterally spread lips and jaw, elevated subglottic pressure, meaning high air pressure beneath the vocal folds, and strong thyroarytenoid-dominant vocal fold activity with a long closed phase, meaning the folds spend a large proportion of each vibratory cycle in contact (Estill, 1988, cited in Spivey, 2008; Popeil, 2007; Spivey, 2008). The thyroarytenoid muscle thickens and shortens the folds, producing a heavy speech-like quality, while the cricothyroid muscle, which stretches and thins them, contributes increasingly as pitch

ascends, allowing skilled belters to sustain this quality into a higher range without the voice cracking (Spivey, 2008).

A particularly important contribution comes from Manternach (2024), drawing on a computerised tomography study by Saldías et al. (2019), cited in Manternach (2024), comparing vocal tract configurations of a trained CCM belter and four individuals with hyperfunctional dysphonia, a disorder characterised by excessive laryngeal tension producing a strained, effortful sound. Both groups showed similarly high laryngeal positions, small pharyngeal widths, and small epilaryngeal outlets, the epilarynx being a tube-like structure above the larynx whose narrowing concentrates high-frequency acoustic energy. The belter, however, uniquely exhibited wider lip and jaw openings alongside these narrowings (Saldías et al., 2019, cited in Manternach, 2024). Manternach (2024) argues that healthy belting is distinguished not by avoiding narrowing but by combining strategic narrowing with selective widening at the lips and jaw. This positions the goal of warm-up for belting not as achieving maximum openness throughout the vocal tract but as facilitating the specific, selective, wide-narrow contrasts that skilled and sustainable belting requires. Taken together, these findings suggest that warm-up strategies for belting may extend beyond general vocal preparation, raising the question of whether exercises that target CCM-specific vocal tract configurations—such as coordinated jaw release, widened oral aperture, and stable phonation under increased subglottic pressure—could be beneficial. However, this remains largely underexplored in the literature and may represent a direction for future empirical investigation rather than an established pedagogical recommendation.

Spivey (2008) identifies a further source of pedagogical confusion: classically trained teachers who encourage carrying chest voice through the *passaggio* apply a framework that is not fully compatible with belting. As belting is speech-derived rather than an extension of classical chest register (Edwin, 1998, cited in Spivey, 2008), warm-ups based on

classical approaches may establish vocal tract configurations that are not optimal for CCM production.

2.10. FINAL CONSIDERATIONS

The literature reviewed in this study highlights several principles that are directly relevant to the design of warm-up practices for novice adult worship singers learning to belt sustainably.

Warm-ups improve how ready the voice feels, but no method clearly outperforms others, and acoustic changes are often not perceptible to listeners (Portillo et al., 2018; Gish et al., 2012; Moorcroft, 2011). This suggests that warm-up functions primarily as a coordination primer shaped by individual sensation rather than as a universally optimised physiological intervention. The specificity principle confirms that warm-up exercises for belting must engage the coordination patterns of belting itself, rather than relying on classical-derived exercises that address different vocal configurations (Hoch & Sandage, 2018; Spivey, 2008). Although a fatigue management framework for singing has yet to be established, CCM singers who regularly belt are arguably the population that needs it most (Hoch and Sandage, 2018; Zuim, Stewart and Titze, 2024).

SOVTEs are ideally suited as the initial stage of a belting warm-up, as their passive airway expansion establishes a neutral, unconstricted baseline from which the selective wide-narrow contrasts of belting can be deliberately developed (Manternach, 2024; Riquelme-Muñoz et al., 2025). Rather than attempting to open the throat through muscular effort, which is counterproductive given pharyngeal anatomy, SOVTE-based resets clear habitual constriction, allowing the singer to purposefully build the specific belting configuration from a neutral starting point (Manternach, 2024; Bozeman, 2021, cited in Manternach, 2024).

These considerations carry particular weight for novice worship singers.

These issues are especially important for novice worship singers. Unlike trained singers, they often lack the body awareness needed to control their voice, which makes it harder for them to tell the difference between

sustainable belting and harmful tension patterns that can sound similar (Manternach, 2024; Saldías et al., 2019, cited in Manternach, 2024).

Unlike conservatoire students who receive regular individual technical feedback, worship singers typically belt through extended services and rehearsals without monitoring. This makes warm-up one of their few structured opportunities for vocal preparation (Zuim, Stewart and Titze, 2024). For this group, SOVTE-based warming up provides a tangible, sensation-based baseline that novices can access without needing advanced technical knowledge, while imagery-based preparation supports the expressive and communal engagement that worship singing requires beyond technical preparedness alone (Katada, Yoshida & Kita, 2025; Moorcroft, 2011).

However, the literature does not yet provide a warm-up framework designed specifically for novice adult singers in worship contexts who are learning to belt sustainably. Existing research predominantly addresses trained and conservatoire-level singers, leaving the specific pedagogical challenges faced by novice worship singers in developing belting coordination across a weekly rehearsal and performance schedule genuinely underexplored (Gish et al., 2012; Portillo et al., 2018; Katada, Yoshida & Kita, 2025). Future studies on warm-up, including novice adult singers in CCM contests, might help fill this gap.

2.11. CRITICAL REFLECTION

Developing this narrative literature review has been challenging yet enriching, significantly enhancing my professional and personal learning. It involved critically engaging with existing literature while reflecting on my experience as a worship singer and vocal teacher. Driscoll's (2007) "What? So What? Now What?" model guides this reflection, facilitating a critical review of experience, deriving meaning, and identifying future practice implications.

WHAT:

The initial aim of this literature search was to explore both peer-reviewed and grey literature on vocal warm-ups in order to identify implications for adult novice worship singers who use belting within Contemporary Commercial Music (CCM). However, due to the large volume of available literature, it became difficult to engage with practitioner-based sources alongside academic research. As a result, the focus was narrowed to peer-reviewed literature to ensure depth and rigour, given time constraints.

Given the extent of existing research, a systematic process of selection was required to identify papers most relevant to the research question. Many studies were centred on classical singing and therefore had to be excluded, unless they offered transferable theoretical insight relevant to belting or CCM practice. This selection process required organisation, time, and coding of themes.

Peer-reviewed sources were accessed primarily through the UWTSD library and Google Scholar, allowing for the updating and expansion of previous knowledge.

The research process was iterative, involving multiple stages of searching, refining, and re-evaluating relevance. The focus gradually shifted toward CCM-specific literature and studies most closely aligned with the research question.

During this process, several key themes emerged. Identifying and organising these themes required balancing relevance and rigour, while triangulating findings across multiple sources rather than relying on single studies.

Developing critical writing skills was also part of this process. In previous modules, this skill had not been fully developed, so this stage represented an area of academic development. A stronger emphasis was placed on critical reflexivity and triangulating literature more effectively in order to strengthen validity and reduce overreliance on individual studies. Although many papers were valuable in isolation, connecting them directly to the research question required ongoing critical judgment. A reflexive journal was maintained throughout the process to document decision-making and monitor potential researcher bias, particularly given my insider position as both a practitioner and researcher (Mercer, 2007; Scott, 2022).

SO WHAT:

Due to limited time, narrowing the focus to peer-reviewed literature strengthened validity and academic rigour, but also potentially excluded practitioner knowledge that is highly relevant in CCM/worship singing contexts.

An extensive amount of the literature found was classical-focused, showing that CCM and belting-specific research is more limited. Additionally, much of the research on CCM or belting included participants who were trained singers, meaning novice belters and novice worship singers are underexplored. This highlights a gap in existing research, which helps to justify the need for studies like this one. This process required working within a large and complex body of literature, necessitating a more selective and structured approach to reading and analysis. The need to constantly filter relevance while maintaining academic rigour helped develop my ability to manage competing priorities between depth and breadth of research engagement.

The study is grounded in a constructivist epistemology, which assumes knowledge is co-constructed through interaction between researcher, literature, and context (Scott, 2022). My dual role as practitioner and researcher shaped which themes appeared most salient, meaning interpretation was not neutral but influenced by my professional experience. Ongoing engagement with the literature also revealed the complexity of warm-up theory, particularly the disconnect between subjective feelings of vocal readiness and measurable physiological changes (Moorcroft, 2011; Portillo et al., 2018). Reflexive journaling helped to manage and make potential bias visible during decision-making.

This process developed my critical evaluation skills and also complicated my understanding of vocal warm-up. Initially, I viewed warm-up primarily as immediate preparation before singing, but the literature reframed it as part of a cumulative process involving vocal dose, conditioning, fatigue management, and recovery (Hoch and Sandage, 2018; Zuim, Stewart and Titze, 2024).

NOW WHAT:

In future literature searches, I would aim to include practitioner-based literature in a more structured and systematic way, rather than limiting focus primarily to peer-reviewed sources at an early stage. This would help to better balance academic rigour with practical relevance, particularly within CCM and worship singing contexts.

I would also develop clearer inclusion and exclusion criteria earlier in the process, particularly around CCM, belting, and novice singer populations, to reduce time spent reviewing literature that is less directly relevant to the research question. Refining search terms at an earlier stage would also help to streamline the process and improve focus. Further development of a more structured thematic approach from the outset would support clearer organisation of complex and sometimes conflicting perspectives surrounding vocal warm-up, vocal dose, and fatigue management.

Reflexive journaling would continue to be used, but with a stronger focus on how it directly informs decision-making and interpretation throughout the research process.

In addition, this process highlights the potential value of more practice-based exploration of vocal warm-ups for novice CCM and worship singers, to better connect literature findings with real-world application and the specific needs of beginner belters.

3. CONCLUSIONS

This literature review has critically examined current research on vocal warm-up, SOVTE-based preparation, vocal dose, and belting within CCM contexts, while highlighting the limited evidence available for novice adult worship singers. Several tentative principles emerge across the literature. Warm-up may function primarily as a coordination primer that improves subjective vocal readiness, although no single approach appears to demonstrate consistent objective superiority, and acoustic changes may not always be perceptible to external listeners (Gish et al., 2012; Portillo et al., 2018; Moorcroft, 2011). The literature further suggests that warm-up may be better understood as part of a broader cumulative process involving conditioning, vocal dose, fatigue management, and recovery rather than as an isolated pre-performance activity (Hoch and Sandage, 2018; Zuim, Stewart and Titze, 2024).

SOVTE-based exercises may contribute to vocal economy and provide a neutral baseline from which belting-specific configurations can be developed, although Manternach's (2024) reset-based interpretation remains relatively recent and requires further independent investigation. Vocal dosimetry research suggests that vocal load accumulates regardless of perceived effort and that subjective ease may not reliably indicate tissue stress (Zuim, Stewart and Titze, 2024). Similarly, evidence indicates that sustainable belting may involve a combination of strategic narrowing and selective widening within the vocal tract rather than generalised openness, although the evidence base remains limited (Spivey, 2008; Manternach, 2024). Imagery-based preparation may also support expressive readiness in ways that physiological vocalisation alone does not fully address (Katada, Yoshida and Kita, 2025; Moorcroft, 2011).

The review also reveals significant gaps and tensions. Positive perceptions of warm-up do not always align with physiological findings, and research remains heavily weighted toward trained or classical populations. From my perspective as both researcher and practitioner, this is particularly relevant

because worship singers often experience substantial cumulative vocal demands without access to fatigue-informed or context-specific pedagogy.

The literature therefore informs the central questions of this study: whether warm-up practices may support sustainable belting development in novice worship singers and how singers experience these approaches in practice. Future research should place greater emphasis on practitioner-based pedagogical studies alongside empirical research and should involve novice worship singers who use belting and structured warm-ups. Future research could also compare different warm-up approaches, including SOVTEs, traditional vocalises, breathing exercises, and imagery-based preparation, to explore which methods best support vocal readiness and sustainable belting in novice worship singers.

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5. APPENDIX ONE (GLOSSARY)

- **Aerodynamic efficiency**
The efficiency with which aerodynamic power is converted into acoustic power during phonation.
- **Breath management**
The coordinated regulation of respiratory activity to maintain appropriate airflow and subglottal pressure during phonation.
- **Chest-dominant**
A pattern of phonation characterised by the maintenance of chest-register qualities at higher pitches, typically associated with increased thyroarytenoid muscle activity and greater vocal fold contact.
- **Electroglottographic voice quality measures**
Quantitative measures obtained through electroglottography (EGG) used to assess vocal fold contact patterns and vibratory behaviour during phonation.
- **Glottal airflow**
The airflow passing through the glottis during phonation.
- **Glottal behaviour**
The vibratory and contact characteristics of the vocal folds during phonation.
- **Hyperfunctional dysphonia**
A voice disorder characterised by excessive muscular tension or hyperactivity of the laryngeal musculature during phonation.
- **Jitter**
Cycle-to-cycle variability in the fundamental frequency of vocal fold vibration.
- **Laryngeal configuration**
The structural and functional arrangement of the laryngeal mechanism during phonation.

- **Phonation**
The production of vocal sound through vibration of the vocal folds as air passes through the larynx.
- **Resonance**
The modification and amplification of sound by the vocal tract.
- **Shimmer**
Cycle-to-cycle variability in the amplitude of vocal fold vibration.
- **Subglottal pressure**
The air pressure generated beneath the vocal folds during phonation.
- **Tessitura**
The part of the vocal range in which a voice most comfortably and consistently performs.
- **Thyroarytenoid muscle (TA)**
An intrinsic laryngeal muscle forming the body of the vocal folds and contributing to vocal fold shortening, thickening, and medial compression.
- **Vocal tract shaping**
The adjustment of vocal tract configuration to influence resonance characteristics and vocal timbre.
- **Vibrato**
refers to the natural periodic oscillation in pitch that characterises a sustained singing tone.